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Electrical Review

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CHARLES W. PRICE, - - - - - EDITOR.
STEPHEN L. COLES, - - - - MANAGING EDITOR.
CHARLES T. CHILD, - - TECHNICAL EDITOR.
STEPHEN H. GODDARD, - - ADVERTISING MANAGER.
RUSSELL HOWLAND, ASS'T ADVERTISING MANAGER.

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GEO. C. MAYNARD, - - REPRESENTATIVE,
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A man who is as yet unknown as a diplomatist has succeeded in getting several of the fashion and society journals to remark upon the comfortable and luxurious appearance presented by women who ride in automobiles. With the assistance of the fair sex almost any old kind of an automobile could be made to achieve success irrespective of its merits.

The excellent programme prepared for the Twenty-third Convention of the National Electric Light Association, which was published in full in the ELECTRICAL REVIEW last week, has attracted additional interest to the forthcoming meeting, at Chicago, and will, without doubt, augment the attendance of delegates. Included in the programme are several questions of practical importance to the central station man which will probably create thorough discussion.

Owing to the high prices of building materials and to labor disturbances in the building trades during the past year, building operations in several of the large cities of the United States have been delayed. Owners of real estate who recently have been deterred from erecting buildings for the reasons noted above have about concluded that the interest charges on their investments in land have become so great that it is advisable for them to proceed as soon as they can with their plans outlined some months ago. The ELECTRICAL REVIEW is informed that most of the prominent architects in New York city and elsewhere are overflowed with work and that beginning late in the Summer or early in the Fall the building trade will experience a boom. Of course, this means that new business will be created for electrical contractors for interior wiring and for many isolated plants. It would seem to be a good idea for the electrical industry to prepare slightly in advance for a rush of work in this direction.

THE IMPORTANCE OF THE INCANDESCENT LAMP.

In the excellent paper by Mr. H. L. Monroe, which was concluded in last week's ELECTRICAL REVIEW, the author well exhibits the importance to central stations of making lamp renewals promptly and of making these renewals themselves. While his argument was sufficient, it was not comprehensive in one respect, for it omitted to show the essential importance of efficiency and of efficient operation of incandescent lights as a factor in station work.

The electric light central station is an institution wherein the potential energy of coal is converted into light by a number of more or less wasteful operations. Between the lump of coal and the light there are losses in the grate, losses in the boiler, losses in the piping, losses in the engines, in the power transmission, in the dynamos, in the conducting circuits and in the lamps. It will be noted, however, by any one who stops to consider it that proceeding backward from the incandescent lamp to the coal pile, the amount of power involved at each operation grows larger and larger, the wastes grow greater and greater and the whole seems like a pyramid inverted and resting upon the lamp as its apex. In other words, a saving in lamp efficiency means a larger saving in geometrical ratio all the way down the line and, finally, the greatest saving at the coal pile. And it is not to be forgotten that the man who shovels coal under the boiler is actually picking up the electric light company's money and destroying it if he uses one ounce of coal more than is absolutely necessary to maintain—not electric current—but light in the premises of the station's customers. For all these reasons there is no subject whatever better worth the attention of the station superintendent than this one of incandescent lamp efficiency.

CONCERNING LIGHTNING.

The Summer is coming and so are thunder storms and about this time of the year the lightning-rod man goes around in a small light wagon through the rural districts and begins to sell rods to the farmers, using generally the same methods pursued by book agents. His stock in trade is a reel of twisted wire ribbon, some alleged insulators, a few gilded points and spikes and an enormous quantity of impudent loquacity. Give him half a chance and the lightning rods are up and the bill promptly rendered.

It is just as well for people who live in the suburbs or the country to know that the average lightning rod has about as much influence on the disposition of lightning to strike their premises as the color of the paint on their houses. There is not enough known to-day about lightning and its habits to formulate a really satisfactory statement of its laws, but a few things about it are known. There appear to be several kinds of lightning discharge, the two most prominent perhaps being best defined as the impulsive rush discharge and the oscillating stroke striking several times over the same spot. We know that lightning is the discharge of an enormous condenser of which the clouds and the earth are plates and of which the electrical capacity is simply enormous. The volume of the average discharge of lightning is probably not very large as compared with the heavy currents used in electric lighting and railway work, but the nearest approach that has been made to measure it indicates that it is of the order of a thousand amperes more or less. Since the discharge is almost invariably either a sudden rush or a violent electrical oscillation the ordinary laws governing electrical conductivity do not control its actions and it is necessary to look to the phenomena of high tension and high frequency discharges in order to understand what may be expected from a lightning stroke. The present state of knowledge on the subject is mostly confined to a number of negative conclusions. We can say with some certainty that the average lightning rod is of no use whatever and can predict with certainty that ample protection would be given a barn, for example, by enclosing it in a thick copper shell. It is conceivable that a lightning rod constructed upon the most scientific principles would be of little avail if it came into the path of certain varieties of lightning discharge. It is again perfectly possible that lightning may take the ordinary lightning rod as a path and go quietly to earth over it without doing damage.

There should not be, in thickly populated regions where houses are close together, any particular uneasiness about the danger of lightning. In places where the population is entirely concentrated and the buildings are close together the fatal results of lightning are practically nil. It is in the country districts, where trees are abundant and houses frequently surrounded by them, that fatal accidents more frequently occur. Furthermore, the city man, as a general thing, has no lightning rod. The country man almost invariably has. In either case, however, the chances of death by lightning are so small as to be utterly negligible.

ADVERTISING AS A FINE ART.

When the electrical business first began to take on such proportions in the United States that it required the service of class journals and became an active element in the field of advertising, the variety of announcement that appeared was of the crudest. Big, black type, and plenty of it, seemed to be the ruling idea that governed electrical advertising, and little or no attempt was made at securing either daintiness of appearance or attractiveness of style in literature that was intended to interest the prospective buyer. If Smith or Jones had anything to sell he simply said so. If he made any claim about it he was apt to say that it was the "best on earth," and possessed of all manner of superlative merit. With the growth of the business and the increasing sharpness of competition there came also a betterment of advertising ideas. More attractive combination of types and pictures were sought for. Care was taken that the trade literature of a manufacturing establishment should be of the same class of excellence as was claimed for the goods that it described. The aesthetic element became more and more in evidence. To-day the advertising literature of many American electrical manufacturing concerns is really beautiful and artistic. Their advertisements in the columns of the technical press bear the stamp of a similar attention to detail of attractiveness, and the big, black type of a decade ago is conspicuous mostly by its absence. A certain fastidiousness of taste has arisen, and for this we all—journals, advertisers and advertisees—ought to be particularly thankful. It is true to-day that any article, though possessing the highest merits, requires a well written, beautiful and truthful advertisement of its qualities in order to achieve success. The general rule may be laid down that the advertisement ought to be just as good as the article it advertises is claimed to be. It is also true that manufacturers in technical industries have at last learned the true function of the advertisement—which is not only to effect an actual sale of the article brought before the eyes of the reader but is always an introduction for the company's traveling salesman and a preparation for the letters which should always be written as a corollary of such advertising as is done by it.

Some months ago the ELECTRICAL REVIEW observed editorially that the equipment of the Boulevard street railway line, in New York city, with the underground electric system would result in a great increase in building operations along that beautiful thoroughfare. This prediction has since been verified and it is doubtless true that when the apartment buildings now in course of erection are completed the Boulevard will run between the handsomest buildings of that type in the world. Real estate operators and builders long ago learned that there is nothing so efficient in popularizing a locality as good electric railway service.

The unspeakable Turk has issued an irade against the importation into his dominions of any manner of electrical apparatus whatever. This is probably a recrudescence of the estimable Abdul Hamid's idea of explosives. He has once before promulgated a similar order, on account of his inability to distinguish between "dynamo" and "dynamite" and his firm conviction that the former was endowed with the deadly properties of the latter.

Electrical Engineering at Purdue University, Lafayette, Ind.

The Purdue University, pleasantly located at Lafayette, Ind., is the engineering school of the state, and owes its existence and support to gifts from John Purdue, Amos Heavilon, state appropriations and the Morrill bills, from which most of the state universities of the country receive a considerable portion of their income. While the university was established about 20 years ago, its growth was not rapid until within the past 10 years, during which time, under the able management of President James H. Smart, lately deceased, it has rapidly developed, until it stands among the leading technical colleges of the country.

In the organization of the university there are five distinct schools: those of civil, mechanical and electrical engineering, of science and of agriculture, each provided with well-appointed laboratories and separate faculties, but all available for the students of any one course, so far as the work of the other courses will be of advantage to the particular course considered.

The home of the school of electrical engineering is a well-appointed three-story structure of dressed stone and brick, finished inside in oil varnished red oak. The building was designed especially for the work of electrical engineering and physics, and is located at about the centre of the college campus, midway between the mechanical building and the science hall. Architecturally, it presents a very pleasing appearance, as viewed from the main approaches. In addition to the large entrance hall there are, on the first floor, four special experiment rooms, provided with large stone-capped brick piers, built on stone buttresses independent of the floor so as to be free from vibration; an office; a large laboratory, fitted with tables and other appliances for general experimental work; a workshop and a dynamo laboratory that is well fitted with electrical machinery. The electrical engineering lecture room, the physical lecture room, the drawing room for electrical design, a large physical laboratory, an apparatus room and two offices are on the second floor.

A photometric laboratory containing five dark rooms and an instrument room, a large drawing room, an office, a blue print room and a store room occupy the whole of the third floor.

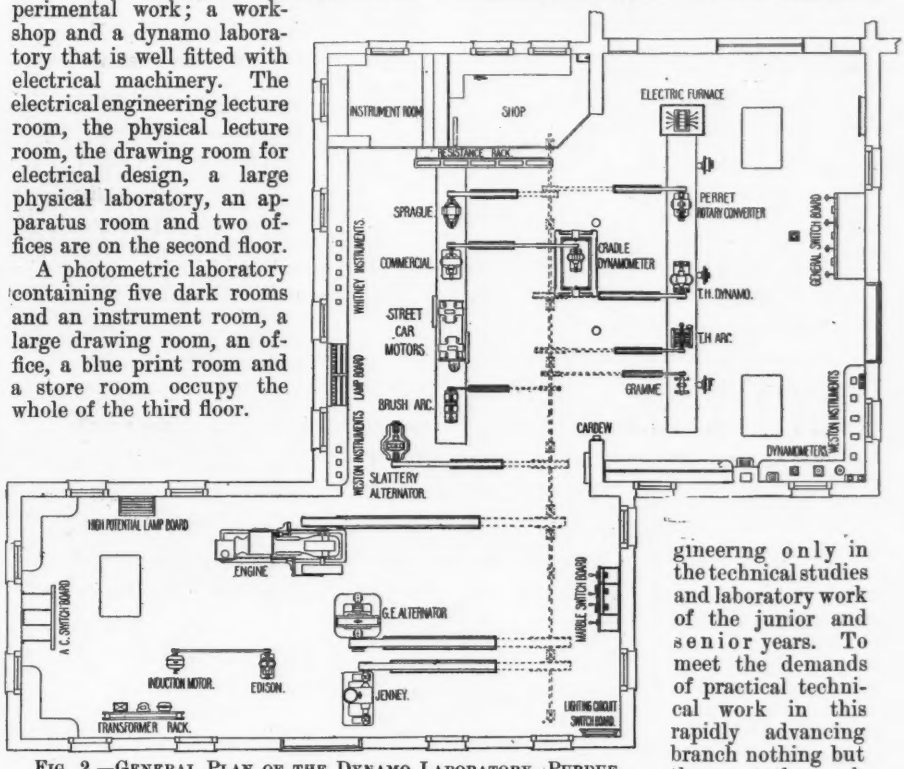


FIG. 2.—GENERAL PLAN OF THE DYNAMO LABORATORY, PURDUE UNIVERSITY.

In the basement of this building there are a constant temperature room, having double walls and fitted with shutters and stone-capped piers, and a storage battery room equipped with the usual accessories.

As the electrical engineer needs to be acquainted with the principles of machinery and the methods of machine work, the course in electrical engineering differs essentially from that of mechanical engineering only in the technical studies and laboratory work of the junior and senior years. To meet the demands of practical technical work in this rapidly advancing branch nothing but the most thorough course in the fundamental fact and principles of the science of electricity and magnetism can prove satisfactory. Hence, a thorough drill by means of text books and an extended series of careful measurements with exact instruments forms the necessary preparations for the latter work.

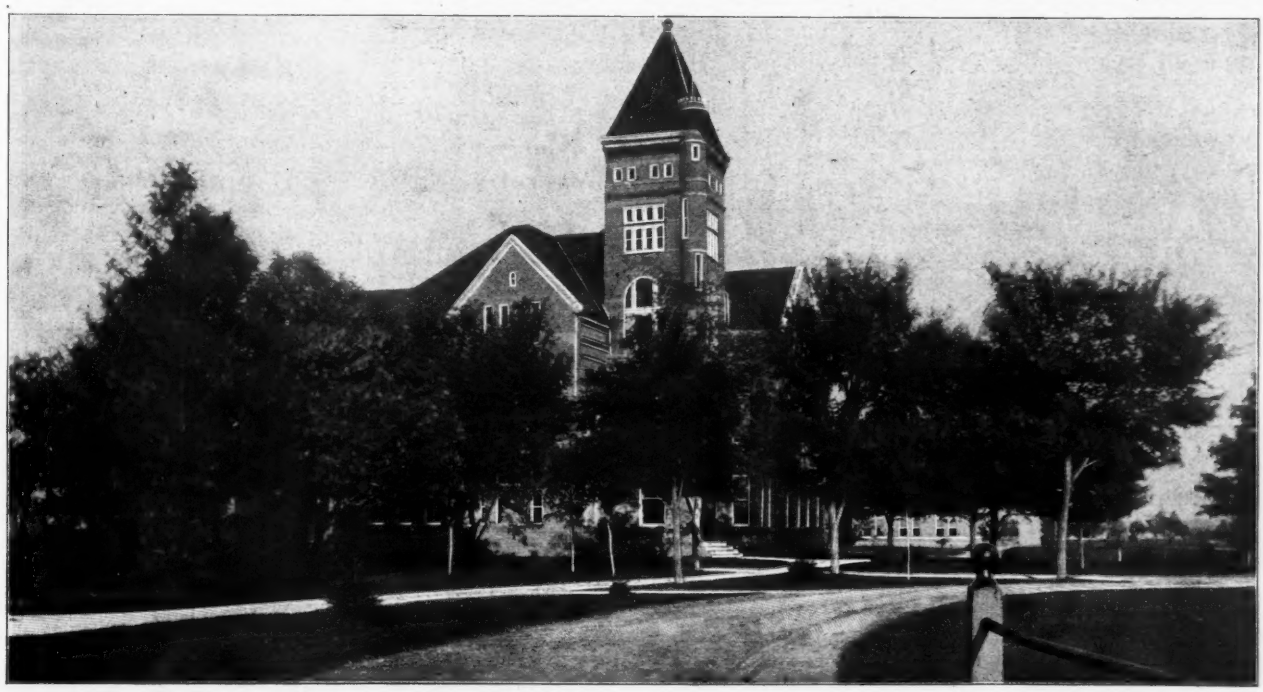


FIG. 1.—THE ELECTRICAL BUILDING, PURDUE UNIVERSITY, LAFAYETTE, IND.

Inasmuch as the students receive the greater part of their training as practical engineers in the senior electrical laboratory, and as this side of the education of an electrician is usually more full of interest to the general reader, the laboratory will be described in detail.

The plan and arrangement of the laboratory is shown in Fig. 2. It is a large room containing upward of 4,000 square feet of floor space, with a high ceiling and well lighted. Beneath it is a basement in which are built the piers for all the machinery on the main floor, and in which is located the line shafting, through the medium of which power is transmitted from the prime mover to the smaller movements. The prime mover is a 100 horse-power high-speed non-condensing tandem-compound McEwen engine. It operates at 300 revolutions per minute and has a speed regulation within one-third of one per cent, as indicated by a recent laboratory plant economy test. It responds promptly to all sudden changes in the load so that the experiments are free from the bugbear of variable speeds when making tests upon the electrical equipment. Steam is conveyed to the engine at 125 pounds pressure through a six-inch main from the boiler plant of the mechanical laboratory, located 800 feet distant. The pipe condensation is collected by a steam trap in the basement and a separator at the engine and is discharged into a dry well behind the building.

The engine drives a three-inch line shaft that is placed in the basement and extends north and south through the middle of the laboratory. The line shaft is divided into three sections, connected by friction clutches. The engine is belted to the short middle section. The general laboratory apparatus, located on the east and west piers, is belted to the south section, and the special machines of larger capacity to the north end. There is a friction clutch pulley provided for each electrical unit belted to the shafting; the system is therefore perfectly flexible and each machine can be operated at will and independently of all the others.

Fig. 3 is a general view of the laboratory taken from its northeast corner. In the centre of the picture and at the back can be seen the general switchboard and the overhead wire racks, a better view of which is given in Fig. 5. At the general switchboard, which affords facilities for making 472 connections, terminate the majority of the leads from the dynamo and motor, brush and field terminals, the lines from the laboratory voltmeters, ammeters and wattmeters, the lines from the rheostats and lamp boards, and the trunk lines from the nine other switchboards, located in the various parts of the building. A special signal board, together with sets of signal circuits and lamps, makes it possible for experimenters located anywhere in the building to signal to one another by means of flashes of light. As the lamps are of different colors an experimenter does not have to be near the signaling apparatus in order to receive the signal, and the system is found to work very satisfactorily. The 10 switchboards have a total terminal capacity of 1,500 connections, and practically all of the terminals are wired up either to the instruments or to the electrical machinery. The majority of the instruments are placed in permanent adjustment, either in the pier rooms, in the photometer room or on a heavy shelf that extends entirely around the dynamo laboratory. The positions occupied by many of the latter are indicated in Fig. 2.

The instruments are of late design and from the best makers. For potential measurements the department is supplied with a set of Kelvin electrostatic instruments, including quadrant electrometer,

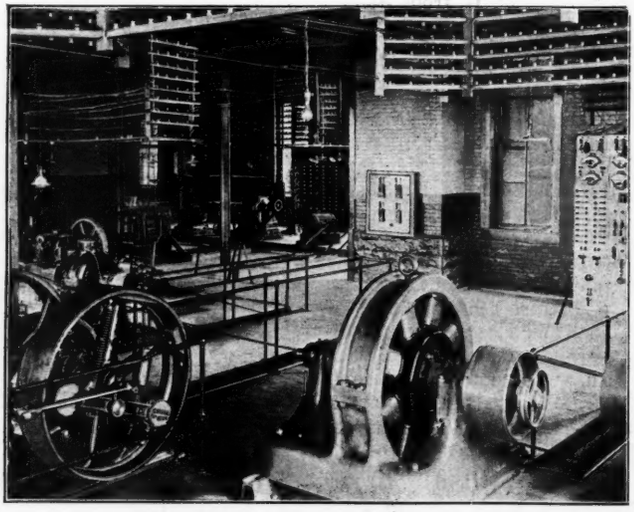


FIG. 3.—VIEW IN THE DYNAMO LABORATORY, PURDUE UNIVERSITY

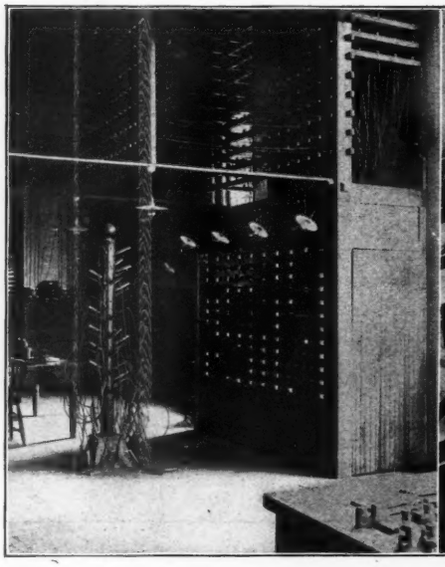


FIG. 5.—GENERAL SWITCHBOARD FOR MACHINE AND INSTRUMENT TERMINAL CONNECTIONS.

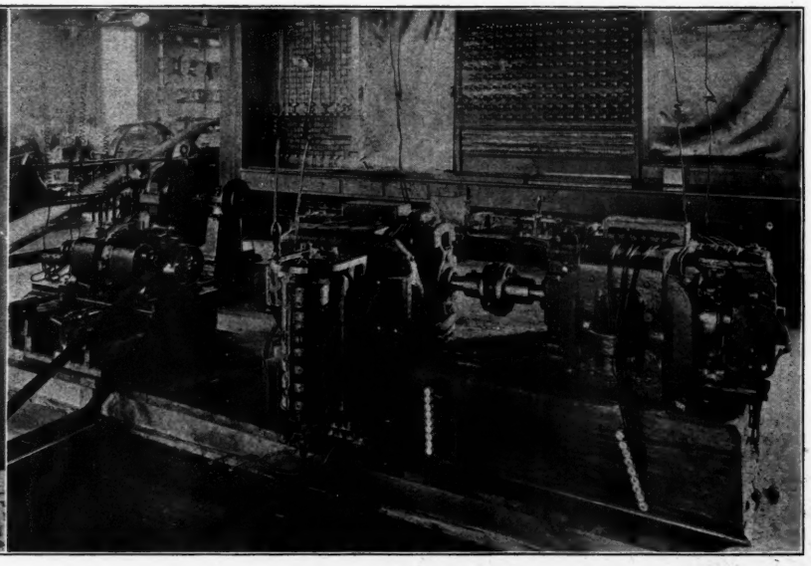


FIG. 6.—THE STREET RAILWAY MOTOR TESTING SET AND MAIN LAMP BOARD.

IN THE ELECTRICAL LABORATORIES, PURDUE UNIVERSITY.

multicellular and vertical high potential voltmeters, Ayrton quadrant electrometer, Edelmann quadrant electrometer, two Deprez-Carpentier voltmeters, a Cardew voltmeter, three Western Electrical Company voltmeters, four Weston voltmeters, one Weston standard laboratory voltmeter with shunts for current, three Whitney and eight Thompson voltmeters. Several of the above are provided with multiplying coils, increasing their range of reading. For measurements of current there are two Kelvin balances, the deciampere and composite, three Weston, two Western Electrical Company, an Ayrton and Perry, two Carpentier, eight Whitney and ten Thompson ammeters; four Siemens electrodynamometers, and several tangent and sine galvanometers, including one of the Helmholtz-Gaugain type with coils 80 centimeters in diameter.

For measurements of power there are two Weston, one Whitney and seven Thompson indicating wattmeters and one Thompson and one Fort Wayne recording wattmeter.

Of other special and delicate apparatus may be mentioned the following: A Kew unifilar magnetometer with corrections from the Kew Observatory, three Weidemann mirror galvanometers, a Rosenthal mikrogalvanometer, four D'Arsonval galvanometers, a Nalder ballistic galvanometer, a Kelvin astatic galvanometer of 13,000 ohms resistance, a Weber electrodynamometer, two Rowland-D'Arsonval galvanometers with dampers and ballistic coils, a Kelvin rheostat, ten standard resistance boxes by Edelmann and Hartmann & Braun, three by Willyoung, an Anthony 100,000 ohm box, a standard B. A. ohm, a one-third and two standard subdivided microfarad condensers, and a 10 microfarad adjustable condenser by Willyoung, an Ayrton secohmmeter and standard of self-induction, a Fischer-Hinnen permeameter, a dip circle by Elliott, an earth inductor by Willyoung, cadmium cells, the usual reading telescopes, simple galvanometers and other instruments of less value.

The laboratory is supplied with several induction coils, X-rays tubes and the apparatus for carrying out X-ray experiments, and tests of his kind form part of the regular work of the junior electrical engineers.

The laboratory course of the junior year also includes practice in wireless telegraphy, the students having so far accomplished a transmission of messages over a distance of four miles.

All the laboratory wiring is installed strictly in accordance with the underwriters' rules, and the greater portion of it is carried on overhead racks and porcelain insulators. This plan enables the student to trace out connections without difficulty. All lines are numbered at both ends and labeled at the switchboard.

The main lamp board is pictured in Fig. 6; the terminals of all the lamps are brought down to mercury cups located in slate slabs at the bottom of the board. By means of these the lamps can be connected all in series or all in parallel, giving a range in resistance of from 1 to 40,000 ohms. The board has a capacity of 100 amperes and is divided into six sections, each of which is wired to the general switchboard.

To supplement the lamp board and in addition to the 12 dynamo rheostats a series of 250 german silver coils, extending from floor to ceiling, have been mounted in a rack shown on the right-hand side of Fig. 7. These coils are so arranged that any desired resistance from .08 to 1,250 ohms can be readily obtained, and they have sufficient capacity so that dynamo

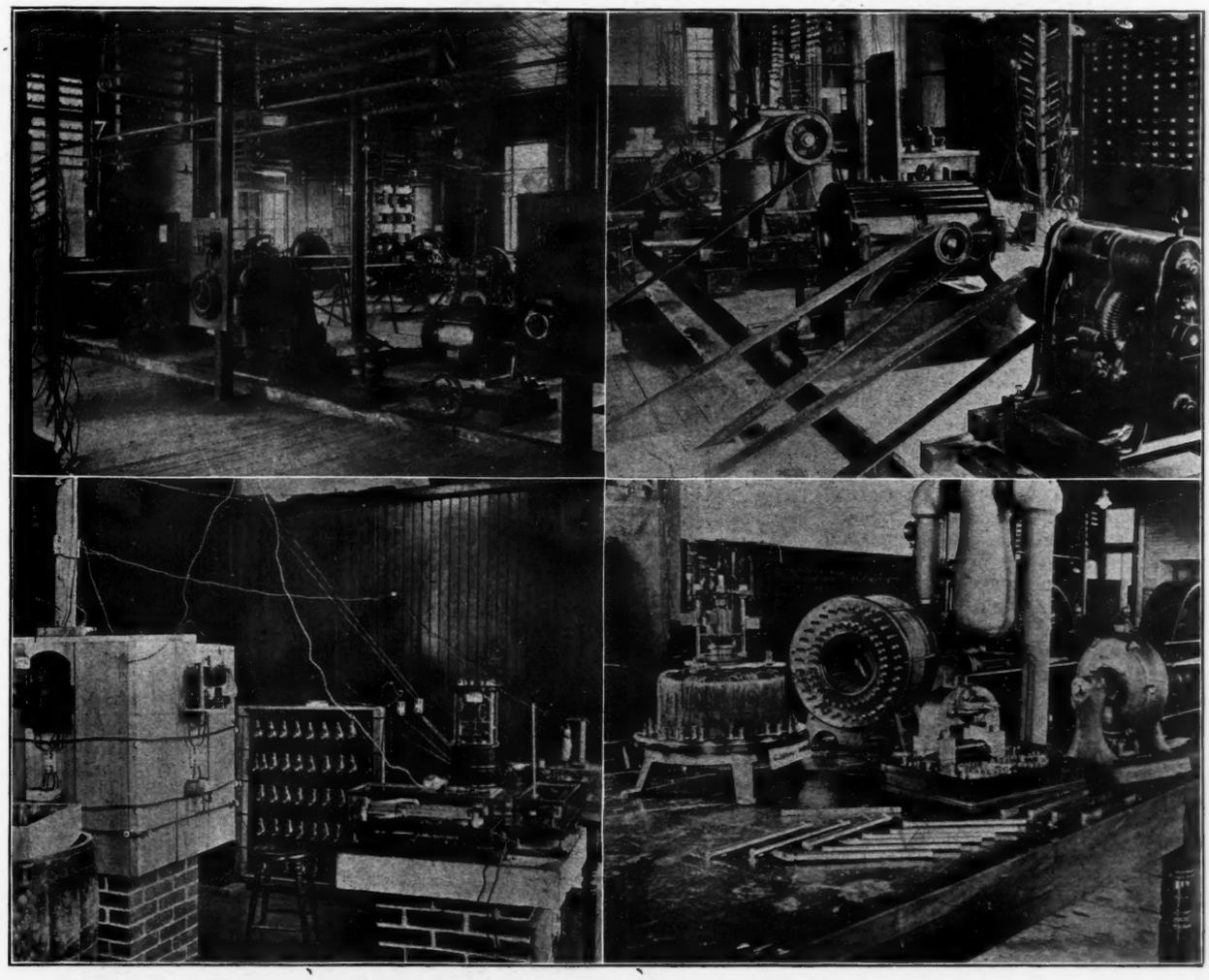


FIG. 4.—DYNAMO LABORATORY. LOOKING NORTHEAST.
FIG. 9.—DIRECT-CURRENT GENERATORS IN BASEMENT.
FIG. 10.—METER TESTING LABORATORY AND STANDARD INSTRUMENT ROOM.
FIG. 12.—EXPERIMENTAL APPARATUS DESIGNED AND MADE BY STUDENTS.

IN THE ELECTRICAL LABORATORIES, PURDUE UNIVERSITY.

currents may be carried as high as 1,000 amperes for the lower resistances. This rack is divided into five main sections, and each section has 25 sub-divisions.

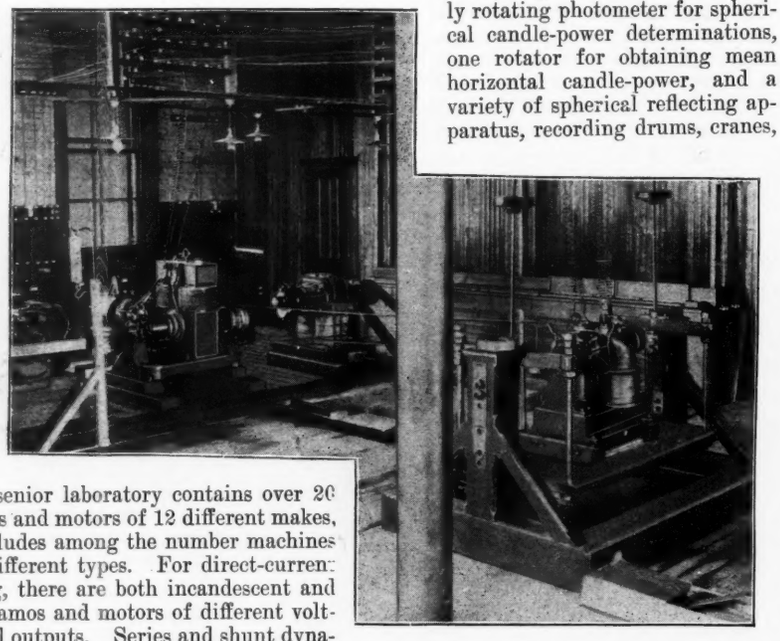


FIG. 7.—CRADLE DYNAMOMETERS AND RESISTANCE RACKS.

The senior laboratory contains over 20 dynamos and motors of 12 different makes, and includes among the number machines of 16 different types. For direct-current working, there are both incandescent and arc dynamos and motors of different voltages and outputs. Series and shunt dynamos and motors, street railway motors, compound-wound generators, and motors differentially wound for constant speed are included among these machines. Some of these dynamos are shown in Figs. 7, 8 and 9. The street railway motor-testing equipment is especially worthy of notice. This set consists of two No. 10 General Electric street car motors with controllers, and all connections and rheostats complete. The reduction gears have been removed and the two machines directly connected through a flexible coupling. When one is operated as a motor, it drives the other, which is then loaded as a generator.

Of the machines shown in Fig. 9, those at the right and left-hand sides of the picture are the most interesting. The machine at the right is one of two Gramme machines, imported from France for the Centennial Exposition, at Philadelphia, in 1876. It is a series dynamo that still does good service as a piece of experimental apparatus. The machine at the left is a rotary-converter, built some years ago. It is of the Perret type, with connections so arranged that it operates with equal success as a direct-current motor or generator, a single or three-phase alternating-current generator or synchronous motor, an alternating series motor, or a converter of alternating into direct or direct into alternating currents.

The two most prominent adjuncts to the senior laboratory are the meter room and the photometer room. The meter room is shown in Fig. 10. The room is fitted with all the appliances for ready and accurate testing on a scientific as well as a commercial scale. The cut shows the Kelvin balances and other instruments and four meters adjusted for testing.

For the study of artifical light sources a fully equipped laboratory comprised in five dark rooms and one instrument and switchboard room is set apart. The photometric equipment includes three Kruss-Bunsen photometers, one Lummer-Brodhun photometer, one Kennelly rotating photometer for spherical candle-power determinations, one rotator for obtaining mean horizontal candle-power, and a variety of spherical reflecting apparatus, recording drums, cranes, candle-power standards and appliances for the study of arc and incandescent lamps.

Professor Matthews has devoted time to perfecting the details of the working facilities afforded by the photometric laboratory. His special devices for the elimination of errors in the photometry of the arc lamp are so ingenious as to deserve careful study on the part of any one interested.

Within the past year the various types of enclosed direct and alternating-current arc lamps have been tested in this laboratory, and numerous incandescent lamps have been standardized. This work is being done in cooperation with the National Electric Light Association's Committee on arc light photometry.

In addition to the standard photometric apparatus, special electrical measuring instruments, rheostats and recording devices are provided for the control of the dynamo and storage battery used in this work. In this connection attention is called to the arc lamp rack shown in Fig. 11, on which the arc lamps are arranged for the study of the controlling mechanism and of the arc itself. In Fig. 13 is shown one corner of the instrument and switchboard room of the photometric laboratory.

In line with the design-room work of the school the students construct each year pieces of special laboratory apparatus. Some examples of this work are illustrated in Fig. 12. The piece at the back is a rotary field transformer of polyphase alternating currents, arranged to give any desired ratio of transformation, between primary and secondary, and currents of any desired number of phases. The piece in the centre is a new form of apparatus for testing the magnetic qualities of iron. The test pieces used with this apparatus are shown in the foreground. The piece on the left is a rectifier of polyphase alternating currents. All the primary and secondary windings and the collector rings and commutator are stationary, and the brushes revolve in synchronism with the rotary magnetic field. To the right is shown a unipolar dynamo designed to operate at 10,000 revolutions per minute. It has thrust bearings and a single field magnetizing coil. This is all student work and it is well done.

Attention is given to electrochemical investigations, both in the class-room course and in the laboratories, and students are encouraged to work up theses in electrometallurgy, and so familiarize themselves with the various electrolytic and electrothermic processes. The laboratory is supplied with the apparatus for carrying on this class of experimental research.

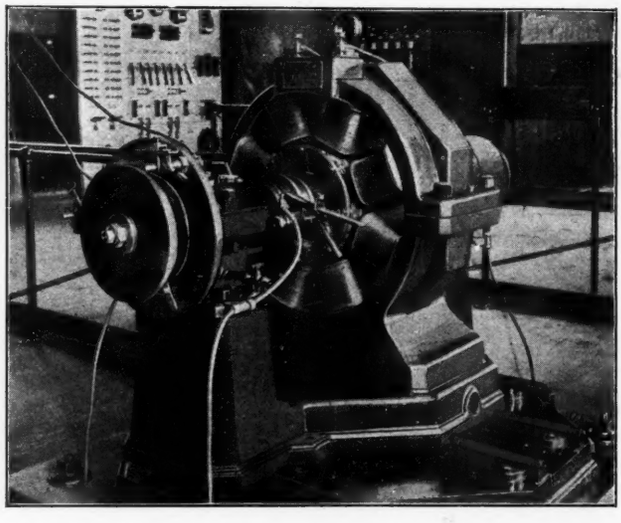


FIG. 8.—THE SLATTERY ALTERNATOR, PURDUE UNIVERSITY.

For alternating-current working there are single and multiphase alternating-cur-

rent generators and induction motors, of both high and low voltage and frequency. There is also a large equipment of transformers of nearly every American make. Some of this apparatus is illustrated herewith. Fig. 8 shows the Slattery alternator. This is a smooth core machine, developing 1,100 volts at a frequency of 133 cycles. The machine is unique in that it develops a perfect sine wave electromotive force. It was designed for and presented to the laboratory by the late Mr. M. M. Slattery. It is fitted with contact disks for determining the wave forms of alternating electromotive force and current, as are all of the other alternating-current machines.

A late addition to the alternating-current apparatus is an alternator of 50 kilowatts capacity, built especially for the Purdue electrical laboratory by the General Electric Company. The test of this generator shows that its full load efficiency is 92 per cent, and its quarter load efficiency 87 per cent; the machine is of the two-phase type with special armature connections, so that either single, two or three-phase currents or the monocyclic adjustment can be obtained at will. This machine is shown in Fig. 16. It is found to regulate well, and that motors belonging to the several systems mentioned can be operated from its circuits without difficulty. For the control of this machine the instruments and switchboard apparatus shown on the central panel of the switchboard of Fig. 16 have been installed; this panel contains two indicating voltmeters, two indicating ammeters and two indicating wattmeters, all of the Thomson type. By the arrangement of the switches and plug connections of this panel, it is possible to connect either one of the voltmeters between any two of the dynamo leads, to connect either one of the ammeters in series with any one of the four dynamo leads and to connect either wattmeter so as to register the power in any circuit leaving the dynamo, without opening or in any way interfering with the currents in operation. The combined equipment is therefore an ideal one for laboratory purposes, and possesses flexibility coupled with great simplicity, that adapts it excellently to the purposes for which it was designed.

Fig. 16 also shows the 500-volt 40-kilowatt Jenney direct-current generator that is used for railway motor testing and power purposes. This is a valuable dynamo for the study of the regulation of direct-current machinery, owing to the fact that the length of the working air gap can be very readily varied by moving the pole pieces up or down on the vertical core. Some very interesting and valuable results have already been obtained in this way. This generator is controlled from the right-hand panel of the marble switchboard, while the Slattery alternator is controlled from the left-hand panel. The switchboard is made of blue marble and its fittings and back connections are thoroughly up to date.

The latest addition to the experimental equipment is a special rotary converter set, built for the laboratory by the Westinghouse Electric and Manufacturing Company. The set comprises two 15-kilowatt rotary converters, made from the same drawings, and constructed out of cast steel and laminated iron from the same lots. They accordingly have the same characteristics. Under normal working they are operated at 7,200 alternations, and have connections and separate collector rings for one, two and three-phase working. The machines are so mounted that they can be directly connected or driven separately by belt. They can therefore be used as direct-current dynamos or motors, as one, two or three-phase alternators or synchronous motors, as a booster set, as a dynamotor set, as a phase-changing set, or as independent rotaries. The machines are wired up to a special switchboard fitted with five voltmeters, five ammeters, three wattmeters, three circuit breakers and the usual rheostats, etc. They are fitted with copper shields for the pole pieces, and are in every particular designed in accordance with the practice used in the design of rotaries of large output.

The storage battery equipment consists

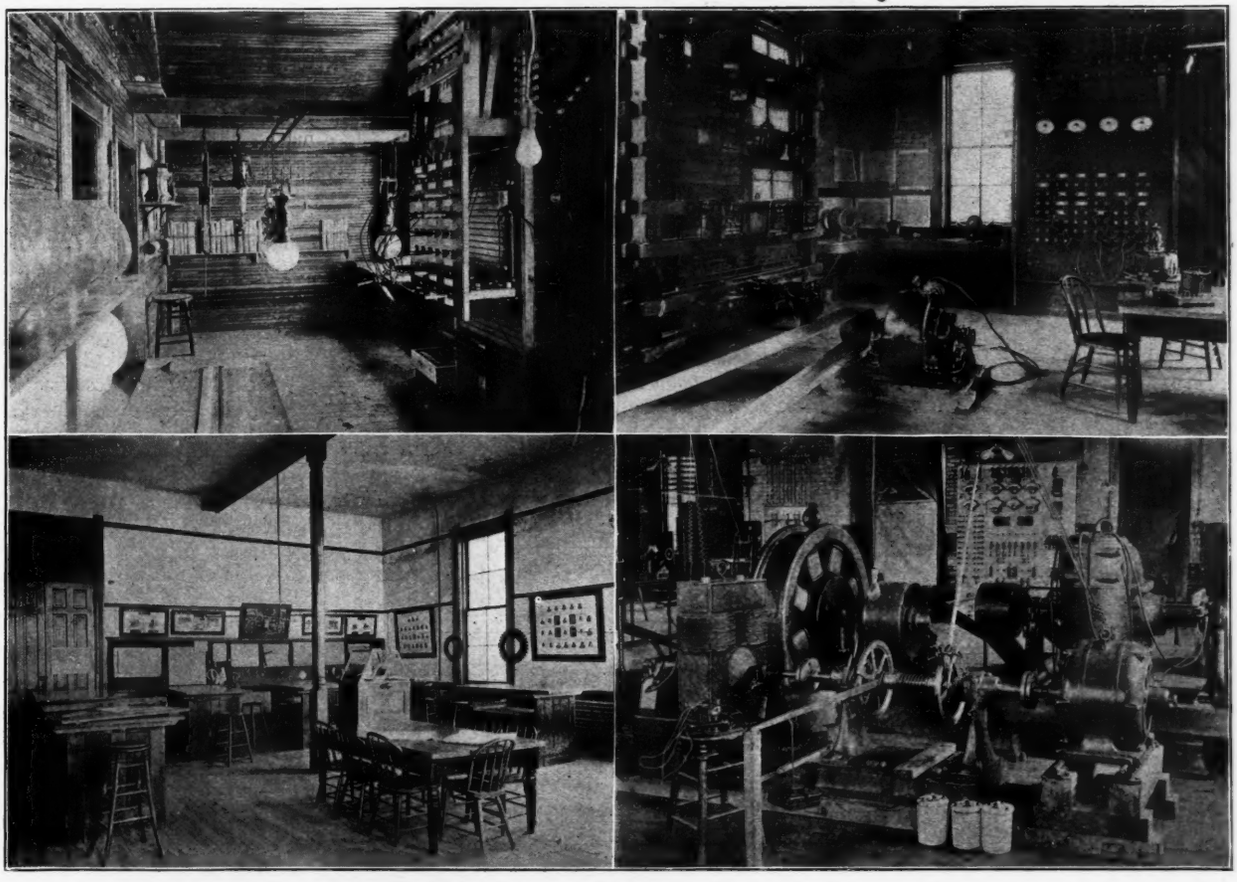


FIG. 13.—SWITCHBOARD AND LAMP ROOM, PHOTOMETRIC LABORATORY.
FIG. 14.—TRANSFORMER RACK AND ALTERNATING-CURRENT SWITCHBOARD.
FIG. 15.—ONE CORNER, SENIOR CLASS ELECTRICAL DESIGN ROOM.
FIG. 16.—POWER DISTRIBUTION SWITCHBOARD AND GENERATORS.

IN THE ELECTRICAL LABORATORIES, PURDUE UNIVERSITY.

of 30 cells of the Julien type, and 60 "chloride" cells. These are mounted in the most approved manner in a basement room equipped with facilities for handling and examining the cells. The battery connections are brought out to a special state switchboard in the junior electrical laboratory on the main floor. The board is fitted with terminal connection for each cell, an overload and no-voltage charging

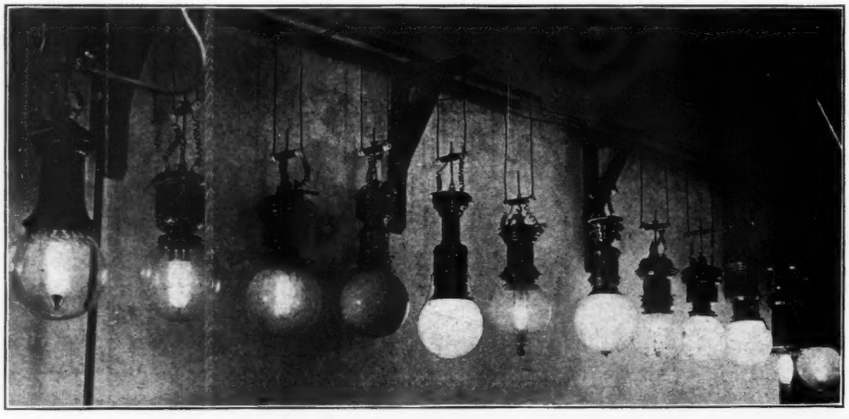


FIG. 11.—DIRECT AND ALTERNATING-CURRENT LAMP-TESTING RACKS, PURDUE UNIVERSITY.

circuit breaker, trunk lines to the other switchboards, and lines to the chemical laboratories in Science Hall.

The laboratory is especially well equipped for testing transformers. In Fig. 14 is shown the testing rack, on which 17 transformers are mounted. The connections are arranged so that the primary and secondary leads are held apart by highly insulated supports, a distance of six inches or over. The leads are then carried overhead to the transformer terminal switchboard shown in the same cut. This switchboard is connected with the general switchboard and the other alternating-current machinery by additional leads; it is also connected to the high-voltage lamp board containing 50 lamps and capable of safely withstanding 5,000 volts pressure. This board is used whenever it is necessary to employ non-inductive resistances in the primary circuits. It is very highly insulated.

A large number of transformer tests have been conducted in the laboratory during the past two years. There are over 30 transformers available for laboratory testing, one of 300 lights capacity, three of over 100 lights capacity and the other smaller. An important series of tests at present in progress are the aging tests of a number of transformers of different makes and most improved construction.

The practical engineering work of the students is not, however, confined to the laboratory. Recently the seniors have conducted tests on one mining electric plant, on one steam power commercial direct-current lighting station, on one gas engine driven commercial, two-phase alternating-current lighting plant, on the La Fayette street railway power plant, including the testing of the motors and car equipments.

The senior and junior students are further afforded the opportunity of participating in inspection trips covering the principal plants and manufactories within the limits bounded by Milwaukee, Chicago, Detroit, Cleveland, Dayton, Cincinnati, Louisville and St. Louis; these cities having been included in the inspection trips so far made. These trips are taken in the Spring of the year.

The non-resident lecture course in electrical engineering is a feature greatly appreciated by the students. During the present school year the University has received visits from five distinguished electrical engineers who have lectured before the classes.

On October 16, Dr. A. E. Kennelly, president of the American Institute of Electrical Engineers, lectured on "Ocean Telegraphy."

On November 15, Mr. Calvin W. Rice, electrician for the New York Consolidated Telegraph and Electrical Subway Company, lectured on "The Development of High-Tension Service."

On January 25, Mr. Bion J. Arnold, consulting and designing engineer, lectured on "The Development of Electrically Operated Railroad Systems."

On March 16, Mr. Charles F. Scott, chief electrician for the Westinghouse Electric and Manufacturing Company, lectured on "The Latest Practice in the Electrical Transmission of Power."

On May 2, Mr. A. V. Abbott, chief engineer of the Chicago Telephone Company, lectured on "The Construction of Electrical Distribution Circuits."

In addition to the special lines of work already mentioned as being carried on in the laboratories this year, namely, the photometric tests upon enclosed arc lamps and the aging tests upon five-kilowatt transformers, there are two other lines of work in progress that give promise of being productive of valuable information. One of these is the comparative test of several single-phase induction motors of between 15 and 25 horse-power capacity. These tests are being carefully conducted by Mr. Mug, with the aid of a new type of transmission dynamometer devised by Professor Goldsborough and shown in Fig. 16. The dynamometer is an instrument of great precision, giving instantaneous readings of the power transmitted to within one one-hundredth of one per cent of the full-load power of the machine tested.

The other line of investigations deals with a determination of the effects of impurities upon the magnetic qualities of commercial irons and steels, and comprises the making of special test pieces, which are subjective to a series of physical and chemical tests. These and allied subjects are being studied under the direction of Mr. Esterline, who is an expert in this department of engineering and the designer of special apparatus for facilitating the tests.

The School of Electrical Engineering is under the direction of W. Elwell Goldsborough, professor of electrical engineering and director of the Electrical Laboratory. Associated with him in the work of instruction of the school are Erwin S. Ferry, professor of physics; Charles P. Matthews, associate professor of electrical engineering; Edward E. Reynolds, instructor in physics; J. Walter Esterline, instructor in the Senior Electrical Laboratory; Lloyd E. King, instructor in the junior electrical laboratory; Edward T. Mug, instructor in electrical design, and John Lenz, engineer of the dynamo laboratory and lighting plant.

FIG. 17.—ONE OF THE PIER ROOMS, PURDUE UNIVERSITY.

SCIENCE BREVITIES

A New Interrupter—The number of new interrupters that has been brought forward since Dr. Wehnelt's type made its appearance is legion. Herr E. Grimsehl contributes to the *Physikalische Zeitschrift* an account of an interesting type which is illustrated herewith. The apparatus is very simple. In a cross-form glass tube, provided with stop-cocks and nozzles for the attachment of rubber tubes as shown in the illustration, is mounted an ordinary organ reed S. Soldered to the tongue of this is a platinum point which dips into a globule of mercury, the level of which can be altered by the reservoir L and stop-cock C. The body of the tube is attached by means of the rubber pipes to a hydrant, the upper prolongation of the tube being intended to act as a reservoir of compressed air so as to give some elasticity to the fluid passing through the reed. The general construction and connections of the apparatus may easily be seen from the illustration. It is claimed by the author that this apparatus will work on low potential circuits with great satisfaction and that it seems to work best at about 100 interruptions per second.

Calcium Carbide—Some interesting figures on the production of calcium carbide are given in one of our French contemporaries. The annual production has already reached the remarkable figure of 256,000 tons, while that of bleaching powder is 225,000 tons, and that of electrolytic copper 166,000 tons. Taking $75 per ton as the average price of the carbide, the total value of the product is more than $19,000,000 per year, a figure which is only surpassed in the electrolytic industry by the value of electrolytic copper and of silver recovered from the slimes due to the copper treatment. The cost of manufacture of the carbide, taking Liebetang's figures, is $43 per ton with water power and $59 per ton with steam engines. It is claimed, however, that at Meran, in Austria, the price has been brought down as low as $37.25 per ton. At present all effort seems to be concentrated on the production of a continuous furnace, though it is claimed that a good one of this variety has not yet been produced. Alternating current gives as good results as continuous current and the use of polyphase current for this work seems to be indicated in the future. While no accurate data exist on the subject it seems that it is not necessary to pulverize finely the coke and lime used in the process, but that granular and quite coarse powders of these substances give equally good results.

Glass Non-Electrolyzable Pipes.

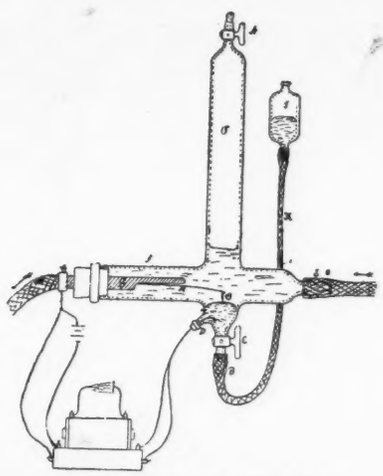
TO THE EDITOR OF ELECTRICAL REVIEW:

Some months ago there appeared in your paper an article by a Boston engineer predicting that some years hence only glass would be used for water mains and drains in cities. Being on the point of putting in waterworks here we are interested in all improvements, and would be obliged to you for telling his name and, if possible, addresses of factories which would be able to supply such glass pipes, that we might get figures. Please inform me also as to factories making glass-lined pipings and also common pipes, by which you would greatly oblige

THOR MOELLER.

Hillsboro, N. D., April 30.

[We would be pleased to receive information about glass pipes and their use for preventing electrolytic action.—EDS.]



A NEW FORM OF INTERRUPTER.

BOOK REVIEWS

"Traité Élémentaire D'Électricité." By R. Colson, captain of engineers and associate at the École Polytechnique. Third edition. Paper. 272 pages. 5 by 7½ inches. 91 illustrations. 1900. Paris. Gauthier-Villars. Furnished by the ELECTRICAL REVIEW at $1.50.

This little work is intended for those who already have some elementary instruction in electrical matters and who desire to put themselves well in touch with the present state of the electrical arts. The fundamental notions of the subject are set forth in the clearest and most explicit manner.

The last trolley link between New York and Philadelphia was completed on April 20, when the Riker-Gaddis-Hine Company made a connection in West Jersey street, Elizabeth, with the Consolidated Traction Company's Elmora branch.

VIEWS, NEWS AND INTERVIEWS

The telephone company at Cairo, Egypt, does not employ girls at its central exchange. Men handle the switchboard, and are required to understand and speak English, French, Italian, Greek and Arabic. Suppose the New York operators had to speak Bowery, Yiddish, Italian and Manhattanese!

The new trolley road from Hazelton, Pa., to Wilkes-Barre will have some novel features. A steam engine to haul freight between the cities is one departure. Another will be a through electric express car from Hazelton to the county seat, that will have a maximum speed of a mile a minute, and make the trip in less than an hour. Preliminary work has already been commenced on the road.

Dr. Makertich Elezarian, of New Rochelle, appeared before Judge Lent, in the County Court at White Plains, N. Y., a few days ago, and asked permission to change his name. He said that many of his patients who wanted to reach him by telephone were unable to pronounce his name. He was born at Teheran, Persia, in 1863, and is a United States citizen. Judge Lent signed an order permitting him to add "Randolph" to his present name on and after May 27.

There is probably not a steam user anywhere who has not been told at different times of the notable economies that he might effect if he would only adopt the particular devices that his informants had for sale, says *Cassier's Magazine*. For all these there is a special interest in the story which Norman Selfe tells in his just published book on "Machinery for Refrigeration," of the man who adopted all the latest improvements offered to him, and who, when he had paid all his bills and summed up what had been promised him obtained the following as the gross saving to be expected: By contorted tubular boiler, 20 per cent; acrobatic fire bars, 10 per cent; steam dryer, 5 per cent; automatic damper regulator, 5 per cent; patent cut-off, 15 per cent; waterless condenser, 20 per cent; economizer and feed heater, 25 per cent; purifier and softener, 10 per cent; making altogether a saving of 110 per cent. He therefore concluded that he should be burning 10 per cent less fuel than nothing, and that his coal heap should be getting larger instead of smaller; but, somehow or other, he found that the coal went away just about the same as before.

The Electrical Equipment of the Cleveland Twist Drill Company's Factory.

An electrical equipment containing the most up-to-date improvements has recently been installed by the Cleveland Twist Drill Company at its factory. Sharing in the increased demand and prosperity of all steel and iron industries, this company has found it expedient to provide facilities for doubling its output. Mr. George S. Rider, the well-known consulting engineer of Cleveland, has been given a free hand in designing the extensions to the factory, and a new plant to supply lighting and power in substitution of the former steam drive. He selected the alternating-current electrical system.

The factory of the Cleveland Twist Drill Company occupies a rectangular lot near the lake front, measuring 340 by 280 feet. The machine shop just completed extends along the west side 340 feet with a width of 42 feet, so that the various departments now enclose the whole lot, leaving an open space in the centre. The new structure is fireproof. At present three floors are completed, but provision has been made for increasing the building to five stories. The ground floor is used as a stock room for the raw materials, consisting mainly of high-class steel from which the drilling tools are made. The second floor throughout its entire length is devoted to milling and other manufacturing processes. It has been fitted up with lines of shafting, driven by electric motors, the milling machines being belted to the shafting. The third floor is utilized for grinding and polishing.

The new power house has been constructed at the centre of the south front.

The building is very substantially constructed on stone foundations, the stone walls being carried several feet above the ground, with brick superstructure. It measures 80 feet by 40 feet. Half of the space is devoted to the boilers and their accessories, and the other half to the generating machinery. The boiler room has been provided with the most modern improvements for labor saving and for mechanical operation. Two water tube boilers, of 150 horse-power capacity each, provide steam at 140 pounds pressure. There is space for duplicating the capacity of the boiler plant. Mechanical stokers feed the furnaces. The coal supply has been given great attention. A branch of the Pennsylvania Railroad runs close to the factory, and a private spur line has been led to the power house. Coal cars dump their contents, which fall into a coal crusher in the basement of the boiler room, and the coal is then conveyed by an endless chain of buckets to the coal bunkers above the boiler room, these bunkers having a capacity of 350 tons. The coal falls by gravity into the hoppers attached to the mechanical stokers, and in passing down, the weight of the fuel is taken and the amount consumed by each boiler accurately recorded. As the ashes are dumped from the stokers they are carried by the endless chain of buckets to the upper floor of the building and thence shot into a receptacle having a capacity of about 50 tons, and are discharged into cars alongside the building.

The electrical equipment has been supplied by the Westinghouse Electric and Manufacturing Company. The generating room contains one 150-kilowatt, two-phase, 220-volt, 7,200-alternation, engine-type generator, which is direct connected to a 250-horse-power horizontal, tandem-compound steam engine, running at 240 revolutions per minute. The fields are divided in a horizontal plane and are fitted upon the bed plate. The armature winding consists of rectangular copper bars, insulated throughout, and held in slots of the periphery of the armature coil by retaining wedges of fibre. The armature is constructed upon a cast-iron spider pressed on the engine shaft with 75 tons pressure. The collectors are keyed separately to the shaft and are constructed upon an independent spider, which is also pressed upon the engine shaft. The field coils are wound for separate excitation from a 125-volt generator, and are supported upon the pole pieces so as to afford ample and thorough ventilation. The 30 pole pieces are constructed of laminated steel, cast solidly into the yoke, thus avoiding as far as possible, eddy currents in the pole pieces.

A direct-current compound wound, multipolar generator is belted to the engine shaft, furnishing current to excite the larger generator. It is provided with an iron-clad, bar wound armature, carbon brushes and ventilated field and armature windings and has an approximate speed of 875 revolutions per minute.

The switchboard stands by the east wall of the building. Its construction follows the standard Westinghouse practice, consisting of three marble panels, one for the generator and two for the feeders. The usual instruments for controlling and operating the currents are mounted upon the panels.

The feeder circuits are carried from the switchboard into the basement of the power house, and thence are conducted by two underground conduits to the basements of the various departments of the works. The conduits have been very substantially constructed, one of them being 160 feet and the other 95 feet in length. They are six feet high, with a width of four feet. The walls are of brick, with stone slab top. These conduits serve not only for the electric feed-wires, but also for the steam pipes for heating the buildings with the exhaust steam, and afford great facilities for repairs in case any of these pipes should leak.

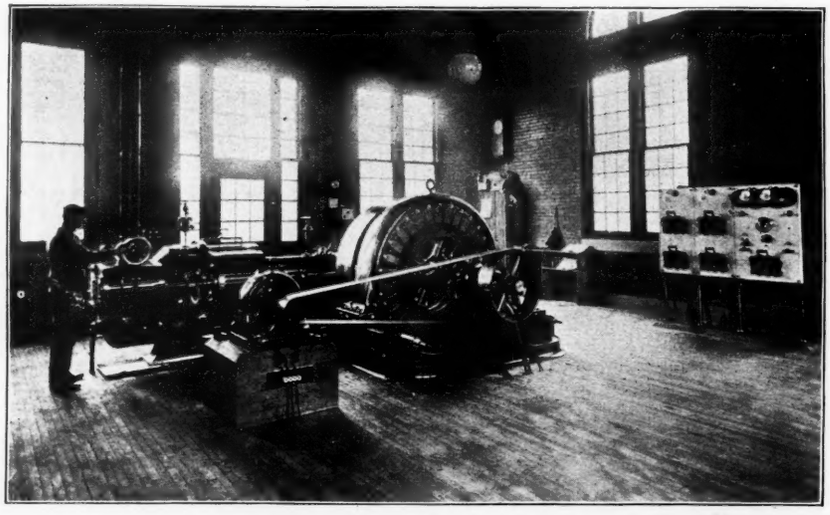


FIG. 1.—INTERIOR VIEW IN THE ELECTRIC POWER HOUSE OF THE CLEVELAND TWIST DRILL COMPANY.

Provision has been made for supplying electric current to 1,000 incandescent and 10 arc lights distributed throughout the buildings. The potential from the generator is 220 volts, which is conveyed to auto-transformers and reduced for the 110-volt lamps. The engineer has very ingeniously devised the lighting circuits

so as at all times to bring an equal load upon each phase of the generator. The factory is divided for lighting purposes into three sections, it being built in "U" shape three stories high, the power house completing the fourth side. On the middle floor of each section are placed two auto-transformers. In each section there are about 300 lamps, bringing about 150 lights on each auto-transformer, or 75 lights on each side of the transformer. The wiring is so arranged that divisions 1 and 4 are fed from auto-transformer "A," and divisions 2 and 3 are fed from auto-transformer "B." The object of this device is to prevent unbalancing of the circuits, as should the lights on any entire side of the building be thrown off, the system would not be unbalanced.

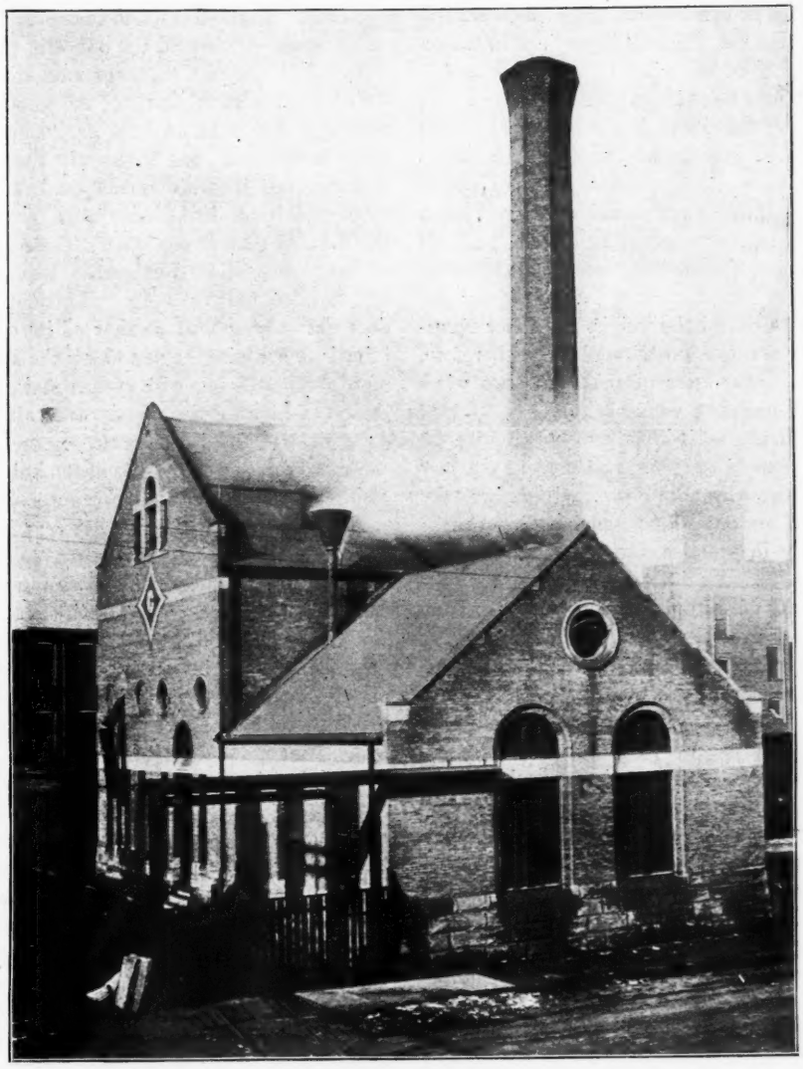


FIG. 2.—EXTERIOR VIEW OF THE CLEVELAND TWIST DRILL COMPANY'S ELECTRIC POWER HOUSE.

An entire change has been made in operating the various floors of the manufacturing departments, by abandoning the former steam drive and substituting lighter shafting directly driven by Westinghouse "Type C" induction motors, a number of which have been installed. The motors are placed upon platforms suspended from the ceiling, occupying no valuable floor space. It is of more than usual interest to note the generally improved appearance of the factory where these motors are in operation. Apart from the fact that the introduction of electricity makes a great saving in the cost of fuel, the surroundings of the factory experience a marked improvement, a far more steady and efficient light being provided, and induction motors are practically noiseless and are very cleanly. It has been found that operatives in these improved sanitary surroundings can do a better day's work.

A visit to the works of the Cleveland Twist Drill Company is instructive in many ways. The rods of steel of various diameters pass through many processes to become the finished product. Material of the finest quality only can be utilized for twist drills. This high-class steel is passed from hand to hand, for annealing, turning, milling, reaming, grinding, tempering and polishing. The machines for these processes are grouped in sections, usually one man operating eight machines. By this method of grouping, any one section of shafting can be cut out when work is not in active operation, thus avoiding all loss of power. The drills made at this factory vary from .013 of an inch in diameter, used by jewelers, up to four inches in diameter. This company claims to make the only drill that has a flute of equal area from point to shank. It has other specialties which need not be mentioned, as its product is well known in the machine shops of all parts of the world.

Electricity is the great magician of the age. A modern advance in electrical science is the introduction of the alternating current system for operating factories. The result is shown in economy of operating expenses and in practically automatic working, since induction motors will run continuously if oiled once in three months, and a little attention is given to cleaning. They will carry a considerable overload, but if this becomes too excessive they stop, and as there are no commutators, brushes or other contact parts, there is no fear of sparking or burning out of the insulation. At starting these motors develop two to two and one-half times their rate of full load torque.

Several large industrial factories in Cleveland and the neighborhood are now being fitted with alternating-current apparatus, and in the present day when speaking of improved machinery, motor-driven apparatus is intended to be conveyed.

Electric Lighting in Connecticut.

The Connecticut Lighting and Power Company, which already controls a majority of the trolley lines and gas and electric light concerns in Connecticut, and which recently purchased water rights and power upon the Housatonic River, has now secured, according to trustworthy information, control of the water rights of the entire Saugatuck and Aspetuck rivers, the Southport stream, the Westport water Company and Electric Light Company, and has formed a new organization under the name of the Southport Water Company. The syndicate proposes to have control in the entire state of the electric and gas lighting, water power and trolley systems. In Norwalk more than $500,000 is being expended in the erection of a modern gas, electric light and power plant.

ONE AND TWO-WIRE SYSTEMS OF ELECTRIC DISTRIBUTION, COMPARATIVELY DISCUSSED.*

BY ALTON D. ADAMS.

The fact that the largest steamship in the world, the Oceanic, has recently been fitted with an electric plant for which the hull serves as one set of main and branch conductors between the dynamos, lamps and motors, emphasizes the claims of advantage made for the one-wire system of ship lighting.

The usual American practice in ship plants is to run a complete, copper circuit of two insulated wires, to which the dynamos, lamps, and all current-consuming devices are connected. This system has no electrical connection with the hull of the ship; both terminals of the dynamos are carried to the switchboard and double-pole switches and fuses are provided for all circuits.

In the one-wire system of ship-lighting, one terminal of each dynamo, usually the negative, is connected directly with the steel hull of the ship, commonly by a contact plate in which a cable from the dynamo terminates. The other, or positive dynamo terminal, is carried to the switchboard and connected through single-pole fuses and switches with each of the wires leaving it. The single wires going from the switchboard each represent one side of a circuit for which the hull of the ship is the other. Each wire connects with its group of lamps, motors or other devices, and the other terminal of each lamp or motor is secured to the ship's hull.

The advantages of the one-wire system include a saving in both materials and labor. As all of the switches are single-pole, the weight of their metal parts is only about one-half of that for double-pole switches. Fuses also being single-pole, their parts require only about one-half the weight and space of the two-pole type. The smaller number of switch and fuse parts requires a smaller and more simple switchboard for mounting them, also smaller distribution panels at other points. The greatest saving of materials effected by one-wire plants is in the weight of copper required for distribution.

The weight of wire required for the circuits of electric plants varies inversely as the electric pressure or volts consumed between their terminals, when the full rated current is flowing, other factors remaining constant. As two wires of equal size and weight connect each lamp or motor with the dynamos, the use of the ship's hull for one side of the circuit reduces the total weight of wire one-half, provided the sizes of wires used for the other side of the circuit remain the same as in the two-wire system. The loss in a wiring system, however, is properly decided on questions of lamp regulation, heating of conductors and power loss, so that the same loss of pressure in the entire circuit is desirable whether the two wire system or the one-wire with hull return be used. Hence it is said that, since the electrical resistance of the hull is very small, the resistance of the wires in the one-wire system may be twice as great as that of one-half of the circuit in the two-wire system; that is, may equal the entire resistance of the two-wire system. If this claim is correct the wires of the one-wire system with hull return may be of only one-half the size of those in an equivalent two-wire system, for the same loss of power and pressure, and the weight of copper necessary for the one-wire plan is, therefore, only one-quarter of that with two wires or a complete copper circuit.

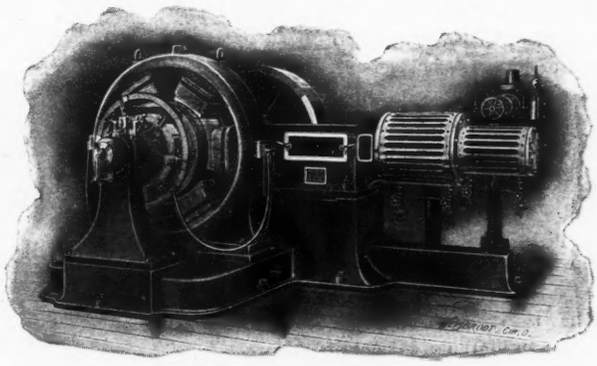
Simple as it thus appears to save 75 per cent of the weight of copper necessary for two-wire ship circuits, there are very good reasons why no such saving can be made in practice, for the great majority of cases. A suitable loss of pressure in the wiring of ship plants usually ranges from two to five volts at full load, being largely decided by considerations of pressure regulation at lamps as well as some regard for loss of power. There is, however, another important factor that can not be ignored, namely, the safe carrying capacity of the wires; that is, the rate at which current as measured in amperes may float through them without causing so great a rise of temperature that they become a source of danger as to fire. Now the safe carrying capacity of a given wire is a constant quantity under the same conditions, depending upon its sectional area and the kind and quantity of its insulation, while the maximum loss of pressure that may occur in a conductor varies directly with its length, and may be very small if the conductor is quite short. In the design of the two-wire system for ship plants with losses of from two to five-volts pressure in the wiring, the permitted pressure loss determines in most cases the size of conductors, rather than considerations of safe carrying capacity. The principal effect of the hull return is to cut the length of wires in two, so that if the same loss is to be had in the wires of the one-wire system that would be allowed in the two-wire system for the same service, it will often be found that the permitted loss involves too great a rise of temperature in the wires, and is, therefore, larger than is permissible. In this case the only course is to select some larger wire whose safe carrying capacity will not be exceeded by the desired flow of amperes. In many cases, for the distances common in ship plants, this limit as to safe ampere capacity of wires will be found to require about the same sizes of conductors in many parts of the one-wire system as would be used for the two-wire.

Another practical limit to the reduction of the areas of wires in the one-wire plan is found in the fact that, for mechanical considerations as to strength, the smallest wire that should be used for general purposes in either the one or two-wire system is about .064 inches diameter, and much more of this particular size, as to length, will be used than of any other. The result of the considerations just named, together with the fact that the weight of insulation does not vary so fast as that of its contained copper wire, tends to keep the sizes of wires for the one-wire system and also their weight at about that in one-half of an equivalent two-wire circuit.

Even on the supposition that the hull of a ship offers no electrical resistance when used as the return for a wiring system, it is by no means possible, therefore, to reduce the section and weight of wire in the one-wire system to one-fourth of the amount required for the two-wire plan. A little consideration will show, however, that to regard the return circuit through the ship's hull as of no resistance is a mistake. One of the fixed rules for the erection of electric wires is that all joints between wires be soldered to insure a low resistance at these points. At switch, fuse and socket terminals clamp joints are permitted, but special contact parts of relatively large surface are provided at these places, and these clamping parts are always of brass or copper, the surface of which is much less subject to the formation of oxides than is that of iron or steel. Now the oxides that gradually form on the surfaces of metals are the main cause of the increasing resistance of unsoldered joints. When metal surfaces are perfectly clean the resistance of a tight joint between them can be lowered but little by the use of solder, but the solder prevents the formation of oxides in the jointed surfaces. It is well-known that any iron or steel surface to which damp air has access soon becomes coated with oxide, and this result can hardly be avoided in the hundreds and thousands of contacts between electrical fittings and the hull of a ship, when the latter is used for the return circuit. The result is that a resistance at these joints, which may be

*From *Marine Engineering.*

trifling when the fittings are first erected, is apt to become quite a serious matter at the end of five or ten years. The hull of a ship, made up with a great number of steel plates, obviously has many joints which an electric current flowing between distant points on the ship must cross. These joints between ship plates are, perhaps, less subject to corrosion than are those between electrical fittings and the hull, but there must be some action of this kind, and the scale on the plate when they are at first joined is rather a poor electrical conductor. Considering both the joints between electrical fixtures and the hull, and also those between the hull plates, it seems practically certain that whatever the resistance of a return circuit through the hull when the ship is new this resistance will gradually increase and ultimately reach a very material amount. The resistance of a well-designed two-wire system for a ship plant is in any case small, and it is at least doubtful whether the ship's hull and the connections thereto would, after a term of years, have a less resistance than one side or half of a proper two-wire system. At a time when electric plants on board ship were quite small, and performed no service apart from lighting, the hull was more apt to give satisfactory results as a return circuit than now, when many hundreds of amperes flow from one part of the ship to others for the operation of lamps, motors and heaters.



A "Triumph" Direct-Coupled Generator.

Considering the factors of mechanical strength, ampere carrying capacity, and the uncertain and increasing resistance of joints, it seems impracticable to reduce the wires of a one-wire system below the sizes that would be used in the corresponding half of a two-wire plant. If the same sizes of wire are used in the two systems for a given case, the one-wire plant will require just one-half the weight of conductors necessary for the two-wire. Some labor will no doubt be saved in the one-wire plant, but its amount will not be so great as might be supposed, since twin-wire cable is not much harder to erect than a single wire, and the labor involved to secure proper attachments to the steel plates of the ship's hull can not be neglected.

The cost of a wiring equipment on board ship must depend on a number of factors peculiar to each case, important among which are the loss of pressure permitted in conductors and the size of the ship. Allowing for the use of the same sizes of conductors in both systems, however, the total saving of labor and material by the one-wire plan will probably not exceed one dollar per lamp (16 candle-power) capacity of the plant for an average case. To offset this rather small saving of first cost for the one-wire plan, it has a few decided disadvantages. Whether electrolysis at the joints between the steel plates of a ship's hull will ever become of importance is as yet an open question, but a practical demonstration of such effects on the hull of a ship may prove an expensive lesson. That heavy electric currents can work great damage when passing out of iron surfaces where moisture is present, and that with little warning until destruction is nearly completed, now has been fully demonstrated to the dissatisfaction of water and gas companies in many parts of the country.

It sometimes happens that the terminals of a fuse become short-circuited or joined through a burnout, or that an arc continues between fuse terminals after the fuse has been melted by a heavy short-circuit at some point on the line which it protects. In a two-wire system either of these mishaps is usually cared for by the fuse on the other wire, since double-pole fuses are regularly used on two-wire work. In the one-wire plant there is no duplicate fuse to blow and open the connection, so a fuse designed to protect some larger wire must either blow out or else the wire which the faulty fuse connection was designed to protect must melt and thus produce a very real danger of fire. The known nature of an electric current is to expend the most of its energy in the generation of heat at those points in its circuits where the resistance to its flow is the greatest. This is illustrated by the incandescent lamp, which consumes most of the energy of the current flowing through it simply because its resistance is usually many times that of the wiring to which it is attached. As the joints between the electrical fittings and the steel hull of the ship grow old some of them are apt to develop a high electrical resistance through being loose or rusted, and such loose joints may become a serious danger as fire risks, because of their development of heat, against which no fuse on the circuit can guard.

Under ordinary conditions a contact with terminals of about 110 volts pressure gives but a slight shock to most persons, but with 220 volt circuits, which are now coming into use for lamps and motors, an unpleasant sensation can be had. It is seldom that the user of lamps and fittings on an insulated two-wire system is exposed to a shock, as he must make contact with both wires at some uncovered points simultaneously, but with the one-wire plant a hand laid on an iron part of the ship, while the other is in contact with the wire or a switch will result in a discharge of current through the body.

In face of these facts the preference that has grown up for two-wire insulated circuits on ships seems to be well founded.

The "Triumph" Direct-Coupled Generator.

In the illustration presented herewith, is shown a direct-coupled generator made by the Triumph Electric Company, of Cincinnati, Ohio, well-known manufacturers of motors and generators. This company manufactures two classes of this apparatus, one known as its standard engine type, having the fields parted vertically, permitting ready access to all parts of the generator without the necessity of in any way disturbing the engine, and the other, known as its marine type, having a field ring in one piece and carrying the out-board bearing bolted to the generator frame. While the latter type was designed for use aboard ship, it is, however, just as applicable for any other class of lighting requiring a minimum amount of floor space and little care. Both of these types embody all the distinctive features of the Triumph construction. The standard engine type is built in sizes from 30 kilowatts upwards. The Triumph Electric Company will be glad to send, on application, catalogues thoroughly describing and completely illustrating its entire line of manufacture.

The Telegraphone.*

The telegraphone is the name of a recently-invented apparatus of particular interest, its principle being based on physical facts hitherto not employed, as far as we are aware.

The inventor is Mr. V. Poulsen, C. E., of Copenhagen, who has now made the technical public acquainted with his general idea, and, besides this, has demonstrated its mode of action in a most clear and convincing manner.

The telegraphone claims to be nothing less than a special kind of phonograph to be acted upon from a distance through the agency of electricity. It is, indeed, an electromagnetic phonograph to be used in combination with microphones and telephones, the sounds from a transmitter being telephoned to the telegraphone, then fixed in invisible writing by this wonderful apparatus, whence it again, at any time, can be reproduced in a telephonic receiver.

The principal difference between the ordinary phonograph and the telegraphone consists in the fact that in the latter instrument the "phonetic writing" of the sound waves is not performed mechanically but only magnetically by means of an electromagnet, the moving basis being made of steel or nickel instead of wax or similar substance. To explain the action: Suppose the electromagnet to be magnetized by telephone currents, while say a steel band passes just close along its poles, the surface of the steel will be permanently magnetized more or less strongly, corresponding to the varying magnetism of the electromagnet, *viz.*, to the telephonic currents. On reversing the action by again letting the steel band, "prepared" as above—in proper direction—be moved quickly in front of the poles of the same or another electromagnet, whose windings now are to be connected to a telephone, varying currents due to the different magnetization of the steel band are induced in the said windings, causing the telephone to repeat exactly the sounds once fixed upon the telegraphone as often as is desired.

As has been proved by numerous trials, the telegraphone gives off the impressed speech quite as genuine and free from secondary sounds as, for instance, the telephone; and in comparison with the phonograph, it has the advantage that the phonetic writing, although not to be wiped out in a mechanical way, may be very easily obliterated by sliding a rather strong magnet (or magnetized electromagnet) along the surface of the steel basis; indeed, whenever this is done, every trace of the writing is done away with and the instrument is once more fit for receiving new impressions.

As to details, a very small electromagnet, say some few millimetres long, is sufficient as well for "writing" as for "reading." Instead of a steel band, it has, in some instances, been found more practical to use a pianoforte wire wound screw-threadlike in grooves upon a horizontal drum rotated, for instance, by a small electromotor, while the "writing" or "reading" electromagnet is shifted along a metallic rod parallel to the axis of the apparatus by means of the screw-laid windings themselves. When all the wire has been "used," the electromagnet is automatically detached and quickly brought back to its starting position by a special arrangement. The next construction of this and the other forms of the apparatus we learn are principally due to Mr. P. O. Petersen, C. E., who has invented a method of his own, not yet published, by means of which it is said to be possible to superimpose several "speeches" upon the telegraphone in a manner that will allow each separate "speech" to be "filtered" out of the instrument.

The form of apparatus mentioned with pianoforte wire will, however, only do for, say, a speech lasting a minute. When the telegraphone is to report a long speech, steel bands, preferably some millimetres long and one-twentieth millimetre thick, have been employed with good results. The band is then unwound from one reel on to another, and is "prepared" by the electromagnet during its motion at any point between the two reels.

In connection with ordinary telephone lines, the telegraphone has been tried in practice as a receiver, and put automatically in action when the bell is rung, then registering what the sender has to say. The subscriber called for can then, at any time (say on returning home), read it off, as will be understood from the above. Another particular application of the instrument is due to its capacity to reproduce the speech to a large number of subscribers at the same time. In this case, the steel band must be a continuous one, arranged and moved, for instance, in the same way as a band saw. All along the band a number of small electromagnets are fixed, the first one connected to a telephonic transmitter, the others to the different subscribers. When the impressed speech has acted upon all the electro-magnets, it is wiped out by a magnet.

So much about particulars. Curiously enough, the inventor has had some trouble in obtaining patents in several countries, the scientific members of some patent commissions denouncing the invention to be a physical impossibility, till convinced by demonstrated facts.

We learn that the telegraphone is to be exhibited this year at Paris, where, no doubt, also some readers of this journal will find an opportunity to listen to the tale of this interesting novelty.

* From the *Electrical Review*, London.

A Letter From Mr. John J. Carty.

To the Editor of Electrical Review:

With your kind permission I will say a few words in your columns regarding the coming election of officers for the American Institute of Electrical Engineers.

I have been informed that a number of associate members and others feel that there is danger that action may be taken limiting the present rights of associate members unless at this time a suitable protest is made. Accordingly they have asked that my name be substituted for that of Dr. Cary T. Hutchinson for manager. The importance of the issue thus raised has prevented me from withdrawing my name from a candidacy not sought by me, and which, if based upon personal considerations, would be distasteful to me for many reasons, not the least of which is the high regard which I have for Dr. Hutchinson.

I have been informed that owing to the use of my name as a candidate for manager, some have the idea that I am opposed to the election of Dr. Pupin for president. Such is not the case, and it is to avoid being placed in a false position in this matter that I have troubled you with this correspondence. Dr. Pupin was my choice for president from the beginning, and I voted for him because of my knowledge of his valuable scientific achievements and excellent personal qualities. In thus testifying my admiration for Dr. Pupin, I do not wish in any way to reflect upon the other candidates prominently mentioned, for I believe that under the administration of any of them the Institute would continue its career of usefulness.

John J. Carty.

New York, May 7.

To Inspect London Tunnels.

President W. H. Baldwin, Jr., of the Long Island Railroad, sailed on the Kaiser Wilhelm der Grosse, last Tuesday, to make an inspection of the Central Underground Railroad, in London. He hopes to acquire valuable information on the working of the tunnel roads in the English metropolis to apply to the tunnels which the Pennsylvania and New York Central roads propose to build in conjunction with their newly acquired Long Island property.

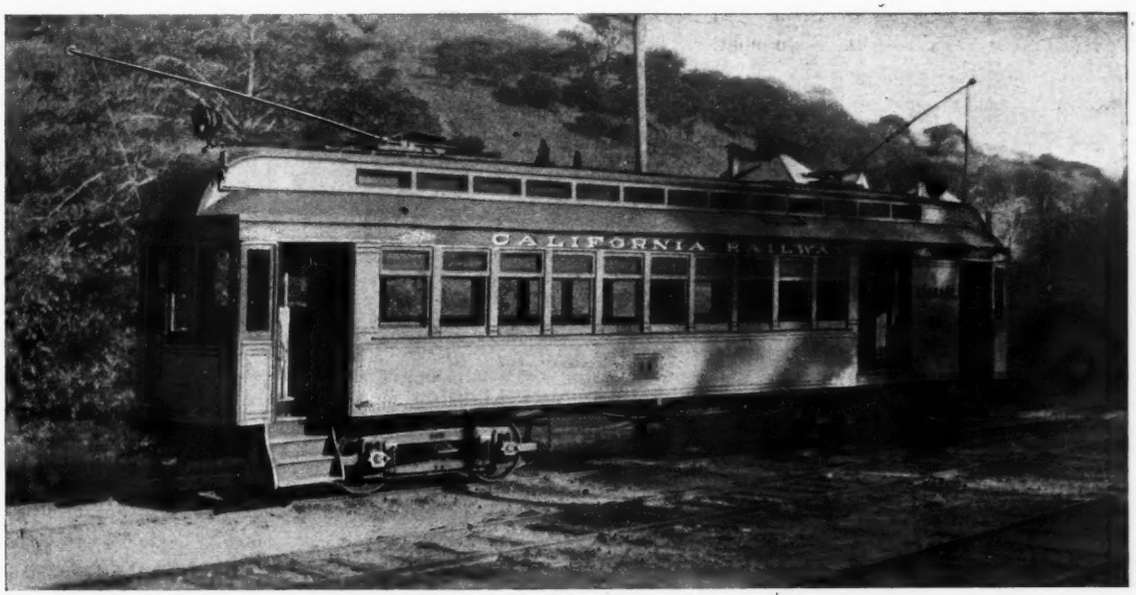
A New High-Speed Passenger Coach Truck.

In the illustration herewith is shown a combined passenger and baggage car mounted on a new type of truck known as "Perfect No. 27," made by the J. G. Brill Company, of Philadelphia. The weight of the car body is 40,000 pounds and the weight of each truck is 7,790 pounds. Cars of this type so equipped are capable of running at any desired speed.

This truck was originally introduced about three years ago and since then a number of improvements in details of construction and design have been made. The makers state that its efficiency in high-speed work and for use under steam railway cars has been effectually demonstrated. Many unexpected and valuable qualities have been discovered in the actual service of this truck.

During the past year the electric railway service in the United States has been so extended that the street railway man is daily confronted with car-building problems which were once supposed to belong only to steam roads. It is now found that long car bodies must be carried in the paved city streets over tram rails and around curves of 35-feet radius and then the same cars must be sent into the country at 45 miles an hour over standard T-rail construction. It is thus seen that the requirements of both steam and street railways are combined. The car body has satisfactorily met these severe conditions but until recently the running gear was not of the desired order of efficiency. The makers of this truck state that three years of service show that it has solved this problem with entire success.

The accompanying illustration shows that a passenger car equipped as described is practically equipped for steam service. The illustration shows a car of the Oakland, Alameda & Piedmont Railway (now the California Railway), of Oakland, Cal.



A Passenger Car Equipped with a New High-Speed Truck.

PERSONAL.

Mr. W. J. Gilmour has been promoted to the position of district superintendent of the eastern department of the Bell Telephone Company of Canada, with headquarters at Montreal.

Mr. E. W. Little, well known in electrical circles, has taken the management of the brokerage office of Byrne & McCown, at 1123 Broadway, New York. Mr. Little's electrical friends will be greeted with a generous welcome.

Mr. Samuel A. Duncan, ex-president of the National Electric Light Association, was a New York visitor last week from Atlanta, Ga., where he now resides. Mr. Duncan has entered his old profession of telegraphy and is now an active member of the staff of the Postal Telegraph-Cable Company.

Mr. F. L. Blendinger has been appointed superintendent of the Seventh District, Eastern Division, Western Union Telegraph Company, vice W. J. Holmes, deceased. Mr. Blendinger has also been appointed in place of Mr. Holmes, superintendent of telegraph of the Erie Railroad Company.

TELEPHONE AND TELEGRAPH

Mr. W. A. Vail has been appointed to the position of assistant to the president of the Chicago Telephone Company, his duties having begun on May 1.

The Erie Telephone System made a net gain of 3,169 subscribers in April. Total number connected April 30, 120,772. Number waiting connection, 6,625.

The Pacific Coast Telephone System made a net gain of 2012 subscribers in April; total number connected April 30 was 73,196 of which 18,688 are in San Francisco.

The last link of the telephone line which connects Milwaukee, Wis., with Marquette and intermediate points was completed and put into operation recently. The closing part of the through line was run from Oconto to Peshtigo connecting with the line to Marquette, thus connecting Milwaukee with those cities.

The following is a list of officers and directors of the American Telephone and Telegraph Company, which has recently taken over the property of the American Bell Telephone Company: President, John E. Hudson; vice-president, Edward J. Hall; treasurer, Wm. R. Driver; secretary, Melville Egleston. Directors: Charles W. Amory, Melville Egleston, John E. Hudson, Alexander Cochrane, Edward J. Hall, Edward P. Meany, Joseph P. Davis, Henry S. Howe and Wm. D. Sargent.

New England Telephone and Telegraph Company's Report.

The annual report of the New England Telephone and Telegraph Company, for the year ended December 31, compares as follows with reports of previous years:

	1899.	1898.	1897.	1896.
Gross	$3,946,354	$3,452,857	$3,097,089	$2,780,652
Expenses	3,162,802	2,735,594	2,436,664	2,175,717
Net	783,552	690,263	660,424	604,934
Dividends	750,216	677,610	569,543	508,180
Surplus	33,336	12,653	90,881	96,754

A comparative statement of revenue and expenses shows:

Revenue:	1899.	1898.	1897.
Exchange service	$2,934,075	$2,646,970	$2,397,734
Toll service	818,459	630,349	555,912
Private line earnings	68,225	66,660	67,738
Messenger earnings	51,778	41,691	37,805
Real estate revenue	1,802	1,844	1,999
Interest	50,402	18,732	16,131
Misc. revenue	21,610	19,640	19,767
Total	$3,946,354	$3,425,857	$3,097,089
Expenses:			
General inc. taxes	$640,107	$513,658	$388,300
Operating	654,075	576,915	491,571
Maintenance	1,384,258	1,210,022	1,491,606
Rental and royalty	220,724	191,478	223,794
Private line	12,399	8,803	10,047
Messenger	50,693	42,118	38,044
Real estate	1,028	848	809
Interest	201,512	191,747	192,489
Total	$3,162,802	$2,735,594	$2,436,664

President Thos. Sherwin, in his report to the stockholders, says: The past year has been one of unprecedented progress in development of the business; 13,270 subscribers were added to the exchange lists. The largest gain of any previous year was 5,524 in 1898.

Total number of subscribers' stations operated at the close of the year was 58,691, as compared with 41,112 at the end of 1898.

An important change in the operation of the toll-line business was made in the adoption of three minutes in place of five as the initial period of conversation with a general reduction of the charges. A large majority of the conversations do not exceed three minutes in length.

The immediate effect of the change has been a material reduction in the monthly receipts from tolls. The directors are confident, however, that the new system will offer such inducements as to result in a larger use of the lines and the restoration of the company's revenue.

The cost of most classes of material employed upon our work has been unusually high during the past year. In each year the expense for repairs and renewals has been more than one-third of the total revenue. In 1899 it amounted to $1,384,258. This sum included no part of the cost for plant enlargement or extension.

It has come to be a recognized fact that telephone property, taken as a whole, with the exception of the ducts for underground cables, must be entirely renewed once in 10 years.

The expenditure for new construction and properties purchased during the year amounted to $1,322,344. The underground system of the company now consists of 219 miles of conduit, containing 1,180 miles of duct, with a wire capacity of 141,600 miles.

During the year 3,797 miles of copper wire, 839 miles of iron wire and 263,933 feet of cable have been placed for toll-line use.

Expenditure upon the plant and equipment aggregated 2,706,603, against $2,099,315 in 1898. The total number of regular employees of all classes is 2,033.

Capital stock to the amount of $983,100 has been issued during the year to provide for new construction and $800,000 for acquiring the Southern Massachusetts Telephone Company.

Average number of exchange connections daily is 341,181, or an aggregate for the year of 109,800,000. The average number of daily exchange calls per subscriber is six and one-half, varying from less than four in some of the small places to upward of 20 in the largest exchange.

Since the close of the year $1,000,000 four per cent debenture bonds have been sold. The second series, $500,000 six per cent bonds, have been redeemed.

The estimated expenditure for maintenance and extension of the property during 1900 is $3,000,000.

Electric Railway and Lighting in Vladivostock.

Commercial Agent Greener, of Vladivostock, under date of March 20, writes in regard to the construction of a street railway, etc., in that city. Mr. Greener sends copy of a letter from the municipal government, as follows:

CITY HALL,
VLADIVOSTOCK, February 25, 1900.

TO THE AMERICAN COMMERCIAL AGENT AT VLADIVOSTOCK.

SIR: It having been proposed to grant a concession for constructing a tramway and an electric light system in Vladivostock, I send herewith plan of the city, a profile of the Svetlanski and Aleutski streets, on which the probable course of the tramway is traced,* and have the honor to request you to make this known to persons in the United States who are skilled in such work; and, also, to give notice that the question of the construction of a reservoir and waterworks for the city of Vladivostock will soon be brought forward.

NEKRASSOFF,
Member of the City Council.

Mr. Greener adds:

The length of the road will be about 12 miles; no favoritism on the ground of nationality will be shown. Electric power must be used. No time limit has been set for sending in proposals, nor for the completion of the work. The city will be responsible for payment.

It is impossible to state the number of lights that will be needed for illuminating the city.

The new Russo-Chinese Bank Building, lately completed, is by far the best equipped building in Vladivostock, and its modern appliances (all the products of American workmanship) have attracted wide-spread attention. The steel ceilings, steam fittings, electrical works, vaults, safes, wall paper—even the furniture—are American. All this has been brought about mainly through the efforts of Mr. S. L. Epstein, one of the directors of the bank, who has been foremost in encouraging American enterprise.

I have taken pains to show the military governor—General Tchitchagoff—circulars, catalogues and extracts from American papers bearing upon public improvements in our own country. He has evidenced his appreciation by having me elected a member of the Statistical Society for the Amur and Maritime Provinces. He is anxious to forward all the projects above outlined.

* Filed for reference in Bureau of Foreign Commerce where they can be consulted by interested parties.

Another Cable in the Philippines.

Gen. A. W. Greely, Chief of the Signal Corps, has received a cable despatch from Colonel Allen, at Manila, saying that the Signal Corps has succeeded in laying the cable line connecting the islands of Cebu and Leyte, in the southern part of the archipelago. Leyte is an island immediately south of Samar and north of Mindanao. Cebu is to the west of Leyte. Both islands are large producers of hemp. The Signal Corps has also completed the construction of a telegraph line northward from Manila to Aparri on the extreme northern coast of Luzon. During Spanish occupancy of the Philippines this land line existed, but it was destroyed by the insurgents. Its reconstruction will enable the garrisons along the line from Manila to Aparri to keep in touch with both points.

General Electric Company's Annual Meeting.

The annual meeting of the stockholders of the General Electric Company was held at Schenectady, N. Y., at noon on May 8. The old board of directors was re-elected as follows: T. A. Edison, J. P. Morgan, Eugene Griffin, C. A. Coffin, T. Jefferson Coolidge, Jr., H. L. Higginson, Oliver Ames, R. T. Paine, Gordon Abbott, G. P. Gardner, George Foster Peabody and J. P. Ord.

EXPORT NOTES

About all the machinery and material for the electrical equipment of an extensive system of street railroads in the City of Mexico and in the federal district is being bought in the United States. Electricity will be first applied to the suburban lines, and then to the principal city lines. Electric cars are now running to Tacubaya and also to Guadaloupe, just outside of which is the shrine for all Mexican Catholics, and pilgrims now go out there propelled by a modern motor.

Word has been received from Paris that the Westinghouse Electric Company has closed contracts for the equipment of the Metropolitan Underground Railway, of Paris, and the suburban lines of the Chemin de Fer de l'Ouest, of France. The company will also equip a large power house for supplying all the surface railroads of Paris with electric current, and has equipped the movable sidewalk at the exposition, as well as an electric railway which runs through the exposition grounds.

La Sociedad General de Centrales Electricas is the name of a company in Bilboa, Spain, which is to utilize the waterfalls of the River Leizaran and develop a force of 2,800 horse-power. A portion of this energy will be employed by the company for an electric tramway, to be built between the towns of Zamarraga and Yumaga, a distance of 37 miles. A Mr. Juan Urrutis, of San Sebastin, Spain, is to erect a large factory for electrochemical industry, in Andoain, where he is also to manufacture carbide of calcium. Other extensive electrical undertakings are projected by this gentleman, for all of which he will need considerable material.

Messrs. Varelax, Cuneo, Hermanos & Company, of Buenos Ayres, Argentina, have been granted a concession by the Argentine Government to build an electric railway line starting from the boundary of the Federal capital to various points, and to reach Martinez, San Isidro, San Fernando and up to the Hotel Tigre. The above firm are to present general plans of the undertaking within a short time and to start to work about September next. They are the proprietors of the electric light station at San Fernando. The new concession which they have just obtained will be worked by them. They will also make all their own contracts.

The municipality of the city of Reichenberg, Bohemia, is at present investigating the advisability of constructing some 12 electric railway lines to connect that manufacturing city with surrounding towns. The Neisse River offers excellent power for the generation of electricity, and the net-work of electric lines is to start from that district. The city of Gablonz has already begun electric railroad construction. Teplitz has appropriated some half-million dollars for the construction of a new electric plant; the contract was recently awarded to the Kummer Company, of Dresden, Germany. Austrian and German engineering concerns are developing quite a trade in Bohemia. Besides the above mentioned company, the Siemens & Halske Company, of Berlin; the Schuckert Company, of Nuremberg, and the Ganz Company, of Budapest, are well represented in the field. Many of the cotton mills and other manufacturing plants are also said to be extensively introducing electricity.

Another of the London street railway companies, in announcing the intention to abandon steam for electricity for the propulsion of its cars, has wounded British pride by declaring that the needed plant can not be obtained in England, and therefore will be imported from America, says the New York *Times*. These admissions of our superiority in the manufacture of electrical machinery have been rather numerous of late, and naturally they are regarded as humiliating in the nation that so long competed successfully with the rest of the world in the manipulation of the metals. One Englishman, writing on this latest revelation, says: "Our electrical engineers, we believe, can hold their own tolerably well in electric lighting, but heavy traction seems to be out of their line. It must not be forgotten that by sending these orders to the United States, Americans are gaining from us something even more important than trade. They are gaining experience and at our expense. Every order of this kind taken away from British engineers renders it more difficult for them to execute another of the same kind. Could not one of our large firms make a desperate attempt to undertake such work?" That is a really pathetic appeal, and the fact that the British engineers are asked to make " a desperate effort" to regain their lost supremacy is highly significant of recent trade changes.

It is in contemplation very shortly to build an electric road from Rochester to Canandaigua, N. Y., and thence on to Geneva. The right of way has been secured, and the survey will soon be finished.

ELECTRIC RAILWAYS

At the annual meeting of the Blue Ridge Electric Railway Company, held in Hagerstown, Md., the following officers were elected: President, B. F. Welty; treasurer, Peter Rouzer, and secretary, Augustus Beck, who, with Dr. I. N. Snively, C. H. Buhrman and Major Norwood, comprise the board of directors.

The Ohio Valley Electric Railway Company, which absorbed the Ironton & Coal Grove, Ohio; the Ashland & Catlettsburg, Kentucky, and Central City & Huntington, West Virginia, lines recently, has awarded the contract for connecting the Ashland & Catlettsburg and Central City & Huntington lines to Kerr & Fox, of Millerport, Ohio. Kerr & Fox's bid is $80,000. There are 400 men at work on the extension, which is to be completed by July 15.

At a special meeting of the stockholders of the Delaware & Susquehanna Electric Railway, held in Elkton, Md., the following directors were elected: Joseph T. Groves, Zion; Taylor Reynolds, Blue Ball; Robert Mackey, Blake; John H. Kimble, Port Deposit; Alfred B. McVey, Fairhill; Carlton Kimble, Rising Sun; J. W. Grove, Pittsburgh; John S. Rossell, Wilmington, Del. The company is capitalized for $100,000. The operations of the company will be in the Fourth, Sixth, Seventh and Ninth districts of Cecil County. Joseph T. Groves was elected president; Carlton Kimble, vice-president; A. B. McVey, secretary and treasurer.

An action involving about $2,000,000 has been begun by the Brooklyn Heights Railroad Company against the Brooklyn City Railroad Company to compel the latter company to fulfill certain obligations. The defendant company leased all its property to the plaintiff for a period of 999 years and the plaintiff took possession on June 6, 1893. The Brooklyn Heights Railroad Company guaranteed to the Brooklyn City Railroad Company the payment of all the latter's fixed charges, interest on $6,000,000 bonds, its taxes, a reasonable sum annually for organization expenses and 10 per cent annually on its capital stock of $12,000,000. It is alleged by the Brooklyn Heights Railroad Company that the Brooklyn City Railroad Company was to issue $3,000,000 in stock and $3,000,000 in bonds for the purpose of changing the motive power from horses to electricity. The Brooklyn Heights Railroad Company avers that only $4,000,000 has been expended by the defendant, and that the other $2,000,000 has not been utilized, as called for by the contract.

NATIONAL ELECTRIC LIGHT ASSOCIATION.

ARRANGEMENTS FOR THE SPECIAL TRAIN.

Everything is moving smoothly in perfecting the advance arrangements for the Twenty-third Convention of the National Electric Light Association, which begins its sessions at Chicago, on May 22, at 10 o'clock A. M., in the Auditorium Hotel. The official programme, which was published in full in last week's ELECTRICAL REVIEW, has attracted considerable attention on account of its excellence, and promises to augment the attendance of delegates. The official arrangements for the special train are explained in the following communication, which should be carefully read by all from the East who expect to attend the convention:

TO THE EDITOR OF ELECTRICAL REVIEW:

As already announced, the various passenger associations have granted a rate of a fare and one-third, on the certificate plan, for delegates and their friends attending the Chicago convention, to be held May 22, 23 and 24. Arrangements have been made to have the New York delegation leave on Sunday, May 20, *via* Pennsylvania Railroad, leaving West Twenty-third street ferry, 1.55 P. M.; Cortlandt and Desbrosses streets, 2.00 P. M.; Brooklyn, 1.35 P. M.; Philadelphia, 4.30 P. M.; Harrisburg, 7.20 P. M.; Pittsburgh, 1.10 A. M.; arriving in Chicago at 5.00 P. M. Monday. The railroad fare is $20.00 from New York, and the berth rate $5.00, making a total of $25.00. The train selected is first-class in all its appointments and carries a dining-car.

In purchasing tickets, delegates should be particular to obtain a certificate from the ticket agent from whom the purchase is made, as in the absence of this certificate no rebate can be allowed on the return passage. In case the number of delegates attending should warrant, a special train will be run as a second section to the train named. Tickets can be procured at any ticket office of the Pennsylvania Railroad, and space reserved by applying to either the undersigned, or to Samuel Carpenter, Eastern Passenger Agent, 1196 Broadway, New York.

C. O. BAKER, JR.,
Master of Transportation.

New York, May 1.

OBITUARY.

Joseph H. Richards, a well-known New York newspaper manager and publisher, died at his home in Montclair, N. J., on May 4. Mr. Richards was one of the founders of *The Nation* and published *The Independent* when he was 21 years old. Afterwards he became business manager of the New York *Evening Post,* and for the last few years of his life had been prominent as an advertising man. Mr. Richards leaves a widow, four sons and one daughter, all married. One of his sons is Mr. H. T. Richards, of the Safety Insulated Wire & Cable Company, New York city, who for some five years was advertising manager of the ELECTRICAL REVIEW.

Charles A. Cheever died of heart failure, after an attack of the grip, Wednesday, May 2. He had been ill about a week at the home of his father, Mr. John H. Cheever, at Wave Crest, Far Rockaway, L. I. Death came during the night—he went to sleep and never awoke. Mr. Cheever, who was born in Boston in 1852, was a helpless cripple from an early age, caused by a fall from the arms of a nurse, and at no time did he weigh more than 70 pounds. He was paralyzed below the waist and was unable to set his feet on the ground. He was carried wherever he wished to go in the arms of an attendant. Despite all this, Mr. Cheever was always a busy man, and whenever he could he devoted himself to electrical apparatus. He patented appliances for drills, elevators and fire engines, but his telephone work brought him the best returns and they made him widely known. He was active in many electrical enterprises, electric lighting, telephony, insulated-wire manufacturing, phonographs, etc. For several years he was president of the Okonite Company. Mr. Cheever was a member of the New York and Seawanhaka-Corinthian yacht clubs and at times owned several boats, and was known to his friends as "the Commodore." Mr. Cheever, who never married, is survived by two brothers, J. D. Cheever and H. D. Cheever.

Telephones on the Erie Railroad.

A press dispatch states that the Erie Railroad, on May 4, began the introduction of telephones to supplant the present telegraph system in its block signal towers. A school of instruction has been conducted at Port Jervis, N. Y., for the past month for the purpose of instructing men in the new system.

The first railroad company in the United States to construct a telegraph line and operate its road by telegraph, was the Erie in 1851. Since then, for a period of nearly 50 years, it has had but two superintendents of telegraph—L. G. Tillotson prior to 1866, and W. J. Holmes since then until his death recently.

Telegraph Companies and Green-Goods Swindlers.

Senator Allan L. McDermott requested Judge Blair in the General Sessions Court in Jersey City, N. J., last week, to *nolle pros.* the indictments against the Western Union Telegraph Company and John B. Bartholf, the Jersey City manager, for aiding and abetting green-goods swindlers in carrying on their operations. The indictment was found last year and Mr. McDermott said that as two terms of court had elapsed since then and the Prosecutor had not moved the trial some disposition ought to be made of the case. Prosecutor Erwin made no objection to the motion. He said it was doubtful if the state could secure a conviction on account of the difficulty of procuring evidence. Mr. McDermott said that every step taken by the Western Union Company and Mr. Bartholf had been taken by advice of counsel. It was impossible for them to distinguish between green goods and legitimate business telegrams. For instance, when a despatch like this came: "Mother is dead, will be on to-morrow," Mr. Bartholf had no means of knowing that it referred to the green-goods business. The sender's mother might be dead or it might be a legitimate business despatch in cypher. Mr. McDermott had informed the police that the company could not disclose to them the contents of telegrams, as they might concern important business matters. Every precaution had been taken by the company to detect and stop swindling telegrams, but they could not be stopped altogether on account of the difficulty in detecting them. Judge Blair granted the motion to *nolle pros.* the indictments.

Receivership Because of a Strike.

Press despatches from Little Rock, Ark., state that President Allan N. Johnson, of the Little Rock Traction and Electric Company asked the United States District Court on May 5, to appoint a receiver for the company on the ground that the company is unable to operate its cars because of the strike. On May 4, there were ten cars in operation. The strikers induced all the motormen and conductors to give up their jobs and join the union. The result is that not a car was running on any of the lines on May 5.

Judge John A. Williams granted the petition of Mr. Johnson, and appointed him receiver of the company's property. He also issued an order restraining any one from interfering with the operation of the cars. The management is now arranging to man all the cars and have them in operation at once

PARIS EXPOSITION NOTES.

The French think the show with its half-million lights so much better at night than in the daytime that after six in the evening they charge two francs instead of one.

In all, there are 7,000 American exhibitors. Of them, perhaps 1,000 are firms of the first importance. Of these, by states, New York comes first, with Illinois second and California third. By sections, New England probably shows the greatest variety of manufactured articles, and the middle west is a close second. California, of course, has the most interesting natural products.

"Both Italy and Spain have built beautiful palaces," says Mr. E. C. Peixotto, in *Scribner's Magazine*, "and it is to be regretted that the United States makes no better showing among her poorer neighbors. I feel sure that every American will feel a sense of disappointment on seeing our government building. Let us hope that its interior will make up in interest what its exterior lacks."

On the night of April 19, for the first time, the lighting arrangements having been completed, the exposition appeared in its full nocturnal glory. In electric lighting the Frenchmen tried to go Chicago one better. The dynamos in the exposition grounds aggregate 20,000 horsepower, of which about 6,000 horse-power goes to operate the lighting. There are 430,000 lights in the exposition. With oil the same light would require the burning of about 84,000 quarts of oil per hour. The effect of all this light is magnificent. The Eiffel Tower rising its 1,000 feet in the air is thick with electric lights.

This is what a correspondent of London *Engineering* has to say about the beginning of the exposition: "In collecting the materials for this hurried review, we naturally commence our promenade by the monumental entrance that offends the eye from the Place de la Concorde. A description of this curious and fantastic structure, especially as regards its extremely skilful iron work now embedded in the decorative plaster, has already appeared and the unfavorable criticism we then expressed is justified by the outspoken severity of Parisian opinion, which is loud in its ridicule of its form and glaring color. Now that the entrance is completed, the work appears even more unsatisfactory than could have been expected, especially since the statue intended to represent the Ville de Paris welcoming her guests, has been put in place. This allegory is personified by a woman in very modern ball costume, and the effect produced is of a most disagreeable character. To make matters worse, the statue is of gigantic size in proportion to the entrance, at the summit of which it stands. As to the gateway, its triangular form and the three supports upon which the arches stand, convey neither an idea of usefulness nor of stability. One would have thought that at least this triumphal entrance might have been finished on the opening day."

The Beaver Dam Electric Light Company, of Beaver Dam, Wis., has been remodeling its plant and is in the market for various electrical supplies, including alternating fan motors, incandescent arc lamps, etc. The old apparatus, having been discarded, is for sale.

A Handsome Exhibit for the Paris Exposition.

In the illustration on this page is depicted the exhibit, for the Paris Exposition, of the John A. Roebling's Sons Company, of New York city and Trenton, N. J. This is a duplicate of the original exhibit which was shipped from New York city on the steamship Pauillac some weeks ago and which was lost with that vessel when she foundered at sea. In a remarkably short space of time the exhibit was duplicated, as shown, and was shipped last week to Paris. The exhibit includes a full line of samples of the John A. Roebling's Sons Company's electrical cables and wires, the whole exhibit being surmounted by an exact model of the Brooklyn Bridge, which, as everyone knows, was built by this firm. Added interest is attached to this exhibit owing to the fact that the original was lost and the duplicate was reproduced in such a short time.

THE JOHN A. ROEBLING'S SONS COMPANY'S EXHIBIT FOR THE PARIS EXPOSITION.

Another Ohio Trolley Road.

The preliminary surveys are now being made for another new electric railway to traverse the northwestern section of the state of Ohio. The line will extend from Toledo to Lakeside, touching the towns of Genoa, Elmore, Oak Harbor, Port Clinton and Catawba. From Toledo the line will parallel the Lake Shore to Elmore and then cut across to Oak Harbor, where the Sandusky division of the Lake Shore is crossed. From Oak Harbor the road branches off to the northeast, to strike Port Clinton and Lakeside. Just who is back of the proposed line is not definitely known, but it is said the same capitalists who are behind the Toledo, Fremont & Norwalk line are backing the project.

CORPORATION NEWS

PHILADELPHIA, PA.—The Consolidated Electric Company has filed papers with the secretary of state, increasing its capital from $100,000 to $4,000,000.

KANSAS CITY, MO.—The Kansas City Electric Light Company, of Kansas City, has filed a statement of an increase of its capital from $450,000 to $2,500,000.

SIDNEY, MO.—The Sidney Telephone Company, of Sidney, has been incorporated as a mutual telephone system; incorporators: John M. Love, P. H. Muran and W. P. Jones.

HARTFORD, CT.—The Upson-Judson Electric Company, of Hartford, has received articles of incorporation to inspect and maintain electrical machinery, etc. Capital stock, $2,000.

PHILADELPHIA, PA.—The Keystone Electric Company, of Philadelphia, has been incorporated, to engage in manufacturing, engineering and construction. Capital, $200,000.

NEW YORK CITY—The Constant Battery Company, of New York city, has been formed. Capital, $100,000; directors: Edmund Tweedy, Bert Levyn and Mark Raffalsky, of New York city.

ALLIANCE, NEB.—The Alliance Electric Light and Power Company has been incorporated, at Alliance, with a capital of $25,000. It is expected to have the city lighted by electricity by the middle of May.

NORWALK, OHIO—The Norwalk Gas and Electric Company has been incorporated with a capital stock of $125,000. This is the new company succeeding the Northern Gas and Electric Company, which now owns the Norwalk plant.

OSWEGO, N. Y.—The People's Gas and Electric Company, of Oswego, has been formed. Capital $450,000; directors: H. P. Kernochan, Jr., and John J. Kennedy, Albany; Harold Footman, E. N. P. Dailey and Samuel Stein, Schenectady.

CAMDEN, N. J.—The Eastern Telephone and Telegraph Company, principal office, Camden, N. J., has been chartered with a capital of $250,000; incorporators: Joseph W. Morgan, John J. Burleigh, E. A. Armstrong.

PHILLIPSBURG, N. J.—The Lehigh-Northampton Gas and Electric Company, principal office, Phillipsburg, N. J., has been chartered. Objects, manufacture electricity, etc. Capital, $250,000; incorporators, Liddon Flick, W. H. Walters, E. G. Holzer.

ITHACA, N. Y.—The Ithaca Telephone Company, of Ithaca, has been chartered. Capital, $10,000; directors: John P. Van Ostrand, F. S. Bronson, Lansing G. Haskins, Fred C. Bloodgood, Mark T. Atchley, William Thomas and Arthur W. Sperry, of Geneva.

PORT WASHINGTON, N. Y.—The Port Washington Electric Light, Heat and Power Company, capital, $7,500, has been incorporated. Directors: Charles F. Lewis, L. Burdette Smull, Jeremiah O'Brien, John J. McDermott, John H. Burtis, of Port Washington.

NEW ROCHELLE, N. Y.—The Huguenot Electric Light, Heat and Power Company, of New Rochelle, has been formed to furnish electricity to New Rochelle, Mount Vernon and the villages and towns of Westchester county. Capital, $50,000; directors: John J. Crennan, John H. Scofield and Martin Corwin, of New Rochelle.

HAVANA, CUBA—The Cuba Company has been chartered to operate railroads and electric railways in Cuba. Capital stock, $8,000,000, of which $2,500,000 is already subscribed for. The stock is divided into shares of $50,000 each. Incorporators: Sir William C. Van Horne, Levi P. Morton, W. C. Whitney, Thomas Ryan, C. G. Hanen, E. A. Harriman, James J. Hill, William J. Bull and H. L. Terry.

BIRMINGHAM, ALA.—Articles of incorporation have been filed in the probate office by the Peoples' Home Telephone Company. The incorporators are: S. B. Claypool, D. M. Forker, W. H. Hassinger and J. J. Altman. The capital is $200,000. The company has recently obtained a charter from the City Council to construct and maintain a telephone system in Birmingham and it is now taking steps to that end.

ELKTON, PA.—The Delaware & Susquehanna Electric Light and Railway Company, of Cecil County, has been organized in Elkton by electing Joseph T. Grove, president; Carlton Kimble, vice-president, and Alfred B. McVey, secretary and treasurer. The capital stock of the company is $100,000. The incorporators went over the proposed route, which is from a point near Newark, Del., to the Susquehanna River.

Electric Tramways in Germany.

Consul Hughes, of Coburg, Germany, quotes from a trade journal the statement that the length of electric lines in Germany shows an increase of 45 per cent over last year, the available power has gone up 57 per cent, and the growth of accumulator installations is represented by the figure of 164 per cent. The tramway accumulators now aggregate exactly a fourth of the dynamo power of the power stations; yet there are very few pure accumulator lines. Overhead conductors continue to predominate. Apart from the two pioneer lines of Siemens & Halske, at Berlin and Frankfort, of the years 1881 and 1884, all the electric roads have been built within the last nine years. The total length is 1,274 miles. Most lines have only a single track, which is made feasible by the almost universal practice of stopping at certain points only. The gas tram line at Dessau, which was considered so successful, will adopt electricity the coming Summer.

New Electrical Catalogues.

The Triumph Electric Company, of Cincinnati, Ohio, has just issued a new catalogue describing its high-grade generators and motors. The catalogue is handsomely illustrated with half-tone plates and numerous illustrations depict in detail the novel points of merit possessed by the Triumph apparatus. Other illustrations show new adaptations of power motors to special machinery and diagrams of connection are given. The catalogue as a whole is very satisfactory and one that should be in the hands of all users of electrical machinery.

The new mammoth catalogue of the Western Electrical Supply Company, of St. Louis, is one of the most complete general electrical supply catalogues that has ever been issued. The manufacture and sale of electricity and electrical appliances has forced itself to be recognized as one of the leading industries of the world. The growth of the Western Electrical Supply Company has been a phenomenal one. From a very small house doing a purely local business, in nine years it has become, if not the largest, one of the largest electrical supply houses in the world, due entirely to its policy of strict attention to business, highest integrity, and the executive ability and foresight of its officers.

The company's new catalogue of nearly 1,100 pages embraces completely everything pertaining to electricity. It is one of the most intelligently arranged catalogues the ELECTRICAL REVIEW has ever seen. It is divided into departments, each department illustrating fully a complete line of the most representative goods pertaining to that especial class of work. It is very handsomely bound and gotten up, and both in size, appearance, and general make-up is eminently excellent. The catalogue covers direct and alternating generators and motors, lighting supplies of every description, street railway supplies, and house goods and telephone supplies, in fact "everything electrical."

The Western Electrical Supply Company states that it is now in a position to equip complete central stations, street railways, telephone lines and exchanges, and is prepared to furnish from stock "everything electrical" in all that the term implies.

The G. & E. Electric Company, Binghamton, N. Y., is comfortably installed in its new building at State and Lewis streets. The company has extensive manufacturing facilities, and is having quite a run on the G. & E. electric boring machine, one of the handiest tools a wireman can possess.

ELECTRIC LIGHTING

The municipality of Buenos Ayres is advertising for bids for a municipal plant. There are already four electric lighting companies in that city, all of them well-backed private corporations.

The annual meeting of the Electric Company of America has been held at Philadelphia recently. The net receipts from all sources applicable to dividends for the year ended December 31, 1899, were $1,041,344. The balance sheet showed total assets of $3,900,405.

The People's Gas and Electric Company has been incorporated to furnish gas and electric light in Oswego, N. Y. The capital is $450,000. The directors are H. B. Kernochan, Jr., and John J. Kennedy, of Albany; Harold Footman, E. N. P. Dailey and Samuel Stein, of Schenectady.

It has been announced that a deal has been completed whereby all the public utilities of Kenosha, Wis., including the gas system, electric lighting, and public heating, are to pass under one ownership. The deal is between the Milwaukee Gas Company, backed by Eastern capitalists, and the different plants in the city. The capital of the company is said to be $400,000.

The new Winchester, Va., Gas and Electric Light Company has been organized. Charles H. Dickey, of Baltimore, Md., was elected president; W. M. Murray, Pittsburgh, vice-president; John H. Cunningham, Westminster, Md., manager; James B. Russell, secretary and treasurer; John B. Shull, superintendent. The board of directors is composed of the officers and Dr. W. S. Love, of Winchester.

At the annual meeting of the Ticonderoga, N. Y., Electric Light and Power Company, the following were elected directors for the ensuing year: Hon. H. G. Burleigh, A. H. Weed, C. A. Stevens, F. L. Brust, C. R. Burleigh, P. F. Roberts, H. G. Burleigh, Jr., W. C. Noyes, E. J. Wood. At a subsequent meeting of the directors, the following were elected officers: President, Hon. H. G. Burleigh; secretary, F. L. Brust; treasurer, H. G. Burleigh, Jr.

The last meeting of the stockholders of the Sandusky Gas and Electric Company, was held, recently, and the business was turned over to the new organization, the Sandusky Gas and Electric Company, recently organized by S. R. Bullock. The total number of shares of stock outstanding is 3,800, and of this number 3,794 were represented at the meeting. The board of directors was decreased from fifteen to seven members, and the following were elected: Geo. R. Butler, C. D. Barney, John Whitworth, George Feick, John Homegardner, Emil G. Schmidt and Samuel R. Bullock.

Municipal ownership of the electric light system of Peru, Ind., at the end of ten years has been practically assured by the action of the City Council in closing a contract with Messrs. Ulen and Parrott and the Indiana Trust Company, of Indianapolis, by the terms of which the city will pay $75 a piece for eighty lights, or a total of $60,000. The parties to the contract with the city, it is announced, have absorbed the present plant, the owners of which several years ago secured a temporary injunction against the city and temporarily blocked a plan for eventual ownership on the plan which will now, it is believed, go through without further litigation.

A Steam Electric Lightship.

One of the largest steam-propelled and electric-lighted lightships ever built is to be used off Cape Hatteras, for the purpose of lessening the dangers of navigation off that stormy point. For the protection of shipping there is already a lighthouse about a mile and a quarter from the outermost point of the Cape whose focal plane is about 190 feet above the level of the sea. A few miles off the shore are the dreaded Diamond Shoals, on which vain attempts have been made to erect a lighthouse. Something over ten years ago a large contracting firm in New York took a contract for the sinking of a huge caisson in the sandy bed of the shore on which to carry the proposed structure. The caisson, however, was wrecked, and the failure seems to have discouraged any further effort. The electric lightship which has been designed to meet the exceptional difficulties of the situation is to be 112 feet between perpendiculars with a molded beam of 28 feet 6 inches, and a depth of 14 feet 10 inches, measured from the main deck beams to the top of the keel amidships. The dynamos and engines for the electric-light plant will be located on the main deck, and within the engine and boiler casing. The accommodations for the crew are forward on the main deck. There will be two hollow steel masts, through which the wiring for the masthead flashlights is to run. These lights, three in number on each mast, are to be adapted for electricity or for oil lamps. The cluster masthead lights will be 59 feet above the water line. The electric plant will be driven by two non-condensing, double-cylinder engines, running under a steam pressure of 80 pounds to the square inch. The vessel will be lighted by 80 16-candle power 100-volt lamps, which will be placed where necessary throughout the ship. The masthead cluster will consist of six 100-candle-power 100-volt lamps, which will be controlled by an automatic flashing device. In addition to her steam whistle, the lightship will be provided with a steam siren, fitted just forward of the smokestacks, for use in thick and foggy weather.

Chicago Elevated Railroad Consolidation.

Mr. C. T. Yerkes, according to Chicago despatches, says that the four elevated railroad systems of that city are to be consolidated. He is quoted as saying: "The elevated railroad systems of Chicago will be consolidated, but not extended beyond their present termini. I have disposed of practically all my interests in the surface lines and am devoting my attention to the elevated roads. They will be greatly improved and will, I have no doubt, form the principal part of our intramural transportation service."

The Sale of the Western Telephone Construction Company.

On April 28 a syndicate purchased the name, patents, good will and all tangible assets of the Western Telephone Construction Company from the receiver in the bankruptcy proceedings instigated earlier in the month.

There was a large number of bidders at the sale. The assets were divided into three classes, one of which comprised the patents, and when this item was offered the bidding was quite spirited between the Western Electric Company and the American Electric Telephone Company, but the bid of the syndicate for the entire assets was for a larger amount than the three separate offers combined, so the new concern got everything.

This syndicate is now incorporating a new company under the same name with a capital of $250,000, and the business is to be operated at 153 to 159 South Jefferson street, Chicago. The new company will be ready to fill orders at once.

The subscribers to the stock of this new company are gentlemen of means, none of whom, it is said, were connected with the old concern, and the business will not be hampered for the want of funds. The practical management of the business will be in the hands of men experienced in the telephone industry and a strong effort will be made to operate the business on a very much larger scale than heretofore.

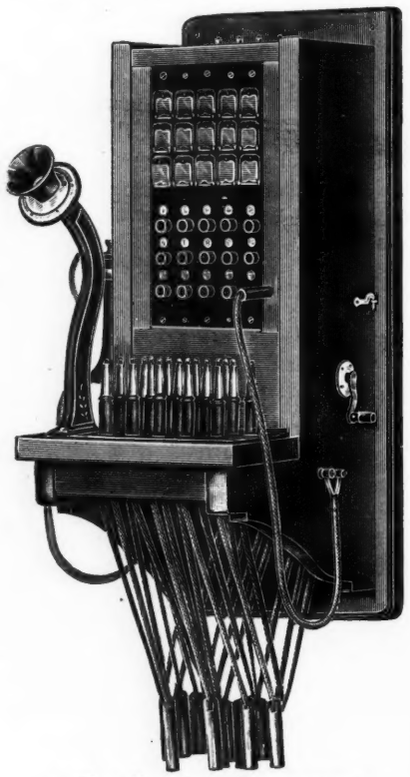
A Proposed Electric Railway in Leicestershire, England.

Mr. S. C. McFarland, United States Consul at Nottingham, England, writes as follows:

Slowly, but none the less surely, electric traction is superseding the inadequate horse railways of England and is even being introduced where these never existed. In a recent report a summary of the situation as regards Nottingham was made. Another enterprise of similar character has practically culminated in Loughborough, Leicestershire, in this district, a much smaller place, and a brief review of the scheme will probably be of interest to American promoters, manufacturers and contractors. The scheme is being promoted by the Loughborough and District Electric Traction Syndicate, Limited, with the support of the Brush Electrical Engineering Company, Limited, Falcon Works, Loughborough. The proposed lines are to run from Hathern through Loughborough and Quorn to Mountsorrel, with a cross line in Loughborough from the Falcon Works. The solicitors are Messrs. Le Brasseur & Oakley, of London, and the secretary is Mr. J. McLachlan, Queen Victoria street, London. The engineer is Mr. C. H. Gadsby, M. I. E. E., of London. The commissioners were Lord Jersey, G. C. M. G., and Colonel Boughey, C. S. I. In his opening statement, a solicitor said the total length of the line was eight and one-quarter miles, with a gauge of three feet, six inches. The motive power would be the overhead electric system. The line commenced at Hathern and ran through Loughborough to Quorn direct. Total population of the district was estimated at 33,450, and of the town, 24,000. The cost of the undertaking was £111,162 ($540,970), and the capital of the company £150,000 ($729,975). The cost of construction would include equipment. The solicitor added that Loughborough was a growing place and a manufacturing town. At the Falcon works there were some 1,500 hands employed, and the construction of the proposed tramways would prove of great utility to these workmen and to others, enabling them to reside outside the town. At present, there was no means of communication between Loughborough and many of the outlying villages and hamlets. The Leicestershire council, he said was in favor of the "very antiquated" system of underground wires. Grooved girder rails would be used, with concrete, granite setts, or tar macadam. The lines would be constructed on the overhead electric system in the usual manner. The cost of construction would, he estimated, be £2,500 ($12,166) per mile on the side of the road; and on the road with tramway construction, £6,000 ($29,199) for a single track.

A New Toll-Line Switchboard.

In the accompanying illustration is shown a new standard toll-line switchboard which is typical of an extensive line of this apparatus made by the Victor Telephone Manufacturing Company, 203 to 207 South Canal street, Chicago,



A New Toll-Line Switchboard.

Ill. The board shown is of 15 drops capacity and has the following advantages claimed for it by its makers: Correctness and simplicity of circuits; simple means for interconnecting the circuits; positive operation; perfection of electrical and mechanical details; freedom from cross-talk and induction disturbances; provision for connecting in multiple any required number of circuits at the same time and for a combination of connections between circuits without creating mutual interference.

The switchboard is wired for metallic circuits to terminals, and is equipped with tubular non-inductive drops wound either for use in connection with lines equipped with series or bridging-bell telephones. The spring jacks are of the new Victor tubular type.

The method of operating this board is extremely simple. As an example, in making connection between line No. 1 and line No. 4, either plug No. 1 or plug No. 4 may be employed. If plug No. 1 is used it is inserted in jack No. 4 and this one movement connects the two lines. Answering the call the operator's plug is inserted in the jack corresponding to the number of the line over which the signal was sent, thus cutting the telephone set into the line circuit. Each line can, of course, be signaled and conversed over separately and at will.

Wall Street and the Electrical Stock Market.

The week's dealings in the stock market were of little general interest. The transactions were in smaller volume than for some time and active public interest was upon a limited scale. The approaching political campaign is believed by many persons to be the cause of the public's lack of interest in the market at the present time. The market closed the week with a firm tone.

On the New York Stock Exchange, General Electric closed the week at 137 bid and 138 asked, a gain of 1 point for the week. Metropolitan Street Railway, of New York, closed at 154¾ bid and 155¼ asked, a loss of 4 points for the week. Third Avenue Railroad, of New York, closed at 107 bid and 108 asked, indicating no change for the week. Brooklyn Rapid Transit closed at 73½ bid and 73¾ asked, a loss of 1⅛ points for the week. Manhattan Railway, of New York, closed at 94 bid and 94⅛ asked, a gain of ⅜ point for the week.

On the Boston exchange, American Bell Telephone closed at 315 bid and 316 asked, a loss of 28 points for the week. Erie Telephone closed at 101 bid and no asked price, a loss of 1 point in the bid price for the week.

On the Philadelphia exchange, Electric Storage Battery was not quoted. Union Traction closed at 37 bid and 37⅛ asked, a loss of ⅝ point for the week. Electric Company of America closed at 9¼ bid and 9⅜ asked, a loss of 4⅛ points for the week.

On the curb, or outside market, in New York, Electric Vehicle closed at 27½ bid and 32 asked, a loss of 3 points for the week. Electric Boat closed at 20 bid and 25 asked, a loss of 1 point for the week.

Wall street, May 5.

The new 1,200-number switchboard of the Citizens' Telephone Company, at Muskegon, Mich., recently installed by the American Electric Telephone Company, of Chicago, is now in full operation, greatly to the satisfaction of the subscribers.

A New Closed-Circuit Battery.

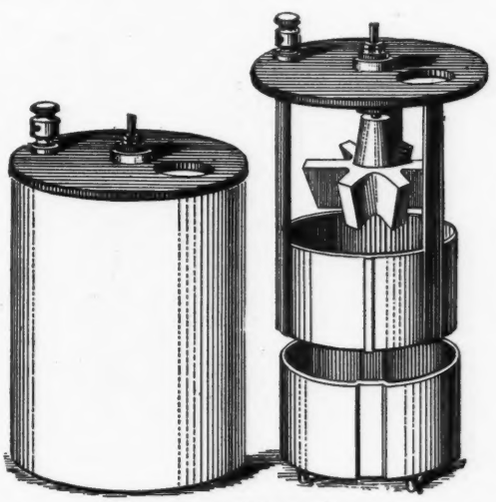
The Federal Battery Company, which manufactures Federal Salt and Federalite for open circuit batteries, is now manufacturing a closed circuit cell of an entirely new pattern, and one particularly adapted for railroad signals, fire alarm service and gas engine or automobile work. The cell is of the copper-zinc type, with caustic potash as the excitant, but differs entirely in its construction from any cell ever put on the market. An illustration of the battery is shown, which gives a general idea of its appearance. The frame of the cell proper is made of cast iron, and is in two sections. The upper part forms the cover, suspending rods, and collar of the frame, with an adjusting cup of cast iron which fits up under the collar and is suspended there on offsets or lugs by giving a half turn of the cover section with a bayonet lock. This simple arrangement obviates handling the elements coated with caustic and saves the workmen from being burned, which can not be avoided in other closed circuit batteries when the renewals are made. This feature of the cell is appreciated by battery men who have the care of large numbers of batteries on railroads, etc.

In the iron cup of this cell is placed loose copper oxide, and suspended from the cover is a star-shaped zinc which is raised or lowered as desired; the positive connection being made to the cover by means of a set-screw. The cell has an electromotive force of about one volt and has a capacity of over 450 ampere hours.

To renew the elements, all that is necessary is to lift the entire frame out of the jar, taking hold of the cover to do so, and setting on the ground; by a half turn of the upper section the cup drops out, and by turning it over, the soft metallic copper can easily be removed with a stick and the cup refilled with a fresh charge of copper oxide. The zinc lasts for two charges of copper, and a fresh one can readily be adjusted without once touching the caustic solution with the hands.

The first cost of this cell is less than any other closed circuit battery now on the market, and the cost of renewal is also much less.

The Federal Battery Company has had these cells doing signal work on the largest railroads in this country with the greatest success; and for all kinds of work they have shown their great lasting ability and large ampere hour capacity. One of the most valuable features of this cell is the impossibility of running out the battery rapidly if accidently short-circuited, as in other closed circuit cells. This point is of immense importance in fire alarm or railroad signal work, where direct short circuit caused by accidental crossing of wires or otherwise might cause loss of life or great damage to property. Some of these cells have done telegraph relay work on the Pennsylvania Railroad for months, and are said to have outlasted gravity cells doing the same work. The cell has been tested for years on practical work, and is now selling in large numbers.



A New Closed-Circuit Battery.

New York City Street Railways.

The New York State Railroad Commission has granted these applications: The Kings Bridge Railway Company, of New York city, to use underground or overhead electric motive power on portions of its roads; the West Tenth Street Connecting Railway Company, of New York city, for permission to construct a street surface railway on West Tenth street, between Sixth and Greenwich avenues; the Eighth and Columbus Avenues Connecting Railway Company, of New York city, to construct a street surface road on the Boulevard, between West Fifty-ninth street and Columbus avenue; the Fort George and Eleventh Avenue Railroad Company, of New York city, to use an underground trolley.

Mr. T. C. Donald, Commissioner of the Central Passenger Association, has issued a circular offering $500 reward for information resulting in the arrest and conviction of any person fraudulently using stamps and dies for changing railroad tickets.

AUTOMOBILES

The men in the School of Applied Science, at Columbia University, are to devote a part of their time to studying automobiles.

The report of the New York Electric Vehicle Transportation Company for the fiscal year ended December 31, 1899, shows the following: Gross earnings, $156,568; operating expenses, $145,189; net earnings, $11,279; other income, $28,290; total net income, $39,670; patents, etc., $4,768; balance, $34,901.

The rules forbidding fast running of automobiles in Paris are working well. On an average 20 motormen are arrested every day in Paris. There is no place in France now where automobiles can be driven beyond a reasonable pace. All future races of automobiles have been declared off. Scores of serious accidents in France show the necessity for this rule. In the race from Paris to Roubaix the winner averaged 42 miles an hour, and in going down hill exceeded 50 miles an hour.

The stockholders of the General Carriage Company, of New York city, met last week at Camden, N. J., and reelected the following directors: Cyrus Field Judson, Joseph Leiter, W. S. Jewell, Robert I. McKinstry. After the meeting it was announced in Wall street as official news that the company had purchased the Sixth Avenue car stables, in Sixth avenue, between Forty-third and Forty-fourth streets, for a price paid stated to be $1,000,000, and that the present structure would be torn down and a five-story building, 200 feet square, erected, especially adapted to the public automobile business.

The Automobile Club of Great Britain started its 1,000-mile motor car run from Hyde Park corner to Edinburgh and return on April 28. Seventy-five vehicles of all sorts from a van to a tricycle started. The run is not to be a race, but an exhibition of the usefulness of the automobile and the skill and intelligence developed in its management. The automobiles started at 7 A. M. The first 10 arrived at Bristol at 6 P. M., and the last at 10 P. M. They were not allowed to exceed a speed of from six to eight miles an hour while passing through towns and villages. The machines that were ahead of the scheduled time were detained at fixed places until the scheduled time had elapsed, when they were allowed to proceed. There was one accident resulting from a collision.

INDUSTRIAL NOTES

Mr. C. H. Wilmerding, the well-known consulting electrical engineer, has removed his offices to Rooms 500-502 Fisher Building, Chicago.

The Montauk Multiphase Cable Company, 100 Broadway, New York city, has removed its offices from the eighteenth to the nineteenth floor, and is now located in Rooms 5 and 6.

A. O. Schoonmaker, 158 William street, New York city, makes a specialty of mica washers and bushings for gas engine manufacturers. He will send samples free to those wishing to give them a trial.

The C. W. Hunt Company, 45 Broadway, New York city, has issued a new pamphlet, No. 001, describing industrial railways for machine shop use. The pamphlet may be obtained free of charge on request.

E. P. Roberts & Company, Cleveland, Ohio, consulting engineers, have published a booklet showing the record of their recent work in the design and supervision of electric lighting and railway plants, etc. It is handsomely illustrated.

Huebel & Manger, 286-290 Graham street, Brooklyn, N. Y., have just issued catalogue No. 5 of their electric and brass goods. The catalogue is handsomely illustrated, and describes in detail this company's well-known line of electrical house goods.

The Ericsson Telephone Company, 296 Broadway, New York city, has issued Part III of "The Ericsson Series." The demand for these little pamphlets has been quite large and the Ericsson Telephone Company will be glad to send them free of charge on request.

The Garton-Daniels Company, of Keokuk, Iowa, maker of the Garton lightning arresters, has published a handsome catalogue containing an interesting treatise on lightning protection. It is a very attractive and interesting book and may be had for the asking.

The Goulds Manufacturing Company, Seneca Falls, N. Y., has issued a number of advance pages from its 1900 catalogue, describing new pumps, etc. These pages also contain revised price lists of the many varieties of pumps and pump auxiliaries made by the company.

Hattiesburg, Miss., believes in advertising. It is a hustling, pushing, growing railroad town, with a business league of citizens, who are enterprising enough to publish a booklet setting forth the town's advantages. The only thing the town seems to need is a trolley road.

The London, Brighton & South Coast Railway has issued a booklet of 32 pages entitled "En Route to the Paris Exposition," which is beautifully illustrated with views of English scenery. It is sent upon application to the company's publishing department, at 3 Fleet street, London, E. C.

The Wallace Barnes Company, of Bristol, Ct., is getting out several new styles of its well-known cold-rolled steel springs. It announces that it is keeping in stock, wire from .003 to .049 inch in diameter. Springs may be enameled or plated, as desired, and are made of flat or round wire, steel or brass.

The Cudahy Packing Company, of Kansas City, Mo.; the B. F. Goodrich Company, of Akron, Ohio, and the Union Gas and Electric Company, of Bay City, Mich., have awarded contracts to the Siegrist Lubricator Company, of St. Louis, to equip all of their machinery with the Siegrist automatic oiling system.

The Gutmann wattmeter for alternating current has "caught on." So claim the Electric Appliance Company, of Chicago, who are the general sales agents. In this connection they are advertising that selling calico without a yard-stick or sugar without scales is akin to the practice of selling current without a wattmeter.

The International Correspondence Schools, of Scranton, Pa., have added a new course to their curriculum, called "Railway Motor Engineering." It is intended to train men for positions as motormen, conductors, car-barn electricians, pitmen, roadmen, inspectors or traffic managers on electric railways. It is an eminently practical course and should lay a foundation for advancement and promotion for its students.

The Buckeye Electric Company manufacture a special "Cellulose" filament for use in the Buckeye incandescent lamp, which is highly commended by central station managers, and lamp consumers generally. The manufacturers state that long average life and maintained illumination give to the buyer of the Buckeye lamp one dollar's worth of light for each dollar expended. Catalogue and special information on application to the Cleveland office or to any of the branch offices.

The Garvin Machine Company, New York, has just issued a beautifully illustrated catalogue of its machine tools, including universal and plain milling machines, screw machines, monitor lathes, hand lathes, chucking lathes, tapping machines, drill presses, cutter grinders, forming machines, gear cutters, profilers, etc. Special labor-saving machines for bicycle and automobile construction form a feature of the catalogue, which is of pocket size, substantially bound in boards, and filled with descriptions and illustrations. It may be had on application to the company's offices in New York.

In the Spring of 1899, Hollister Brothers, printers, installed 19 Western Electric Company motors to operate their printing plant. It was necessary for them to change their location before the first of May, and they found that with the use of motors it was easy for them to move one press at a time, have the same set up and in operation before another one was moved. By this means they were able to move their entire establishment without a single interruption to business, not more than one press being inoperative at one time. In a recent booklet issued by them they give a number of advantages in presses operated by electric motors, and now state that in moving they have found one other advantage.

The Emerson Electric Manufacturing Company, St. Louis, announces that it is in a position to make prompt shipments of all regular desk, bracket and ceiling fans of its manufacture from New York city. The Emerson Company has largely increased its manufacturing facilities, and is in position to make prompt shipments. Three car loads of desk and ceiling fans have already been forwarded to its New York warehouse and additional car loads will be forwarded from time to time as occasion demands. All correspondence and orders sent to the Emerson branch office at 136 Liberty street, New York city, will obtain the same prompt and careful attention as if addressed to the home office in St. Louis.

An Independent Telephone Emblem—The Eureka Electric Company, 157 South Canal street, Chicago, Ill., has just designed an emblem for independent telephone companies which is shown in the illustration herewith. The Eureka Electric Company states that it will send free upon application to any independent telephone company an electrotype of this design for use on its stationery. The Eureka Company is making lapel buttons in the same design which will be supplied free of cost. The company states that it is at work at the present time upon a central energy telephone system which will be ready for the market within sixty days and which will contain several improvements of advantage.

The Booker Carbon and Battery Company.

The Booker Carbon and Battery Company has been incorporated under the laws of Missouri with a full-paid capital of $50,000. The company has secured the manufacturing plant at 2431 to 2440 De Kalb street, St. Louis, Mo., formerly occupied by the Phoenix Battery Manufacturing Company. New and improved machinery is being installed, and the company will be in a position in a short time to make deliveries of everything in the battery and carbon line. Colonel S. G. Booker is the moving spirit in the new concern. Colonel Booker is well and favorably known to the fraternity at large as a carbon manufacturer, and his many friends will be glad to learn of his success in forming a new company.

ELECTRICAL PATENTS

[Specially reported for this journal by E. S. Duvall, solicitor of patents, Loan and Trust Building, Washington, D. C. Copies of any patent may be secured for 10 cents each.]

ISSUED MAY 1, 1900.

648,378 System of electrical distribution; Oskar Behrend, Frankfort-on-the-Main, Germany—An alternating-current generator, a branched main circuit, a translating device in each branch, and electro-magnetic switches controlling each branch and connected in a shunt from the main circuit.

648,388 Voltage-regulator; W. H. Chapman, Portland, Me.

648,432 Railway signal; S. C. Prentiss, Detroit, Mich.

648,446 Electro-magnetic coil; R. Varley, Jersey City, N. J.—A free stranded terminal, consisting of a section of the coiled wire and a short section of tin-coated wire, twisted therewith, combined with a strand of insulating material fixed to said stranded terminal and to the surface of the coil.

648,463 Process of abstracting silicon from silicious materials; Richard L. Knaur, Vienna, Austria-Hungary.

648,481 Electrical resistance; A. W. Beresford, Westfield, N. J.—A plurality of cast-metal forms or grids, so separated from metallic contact by insulating pieces as to admit free access of air to the surface of said grids, and made into a rigid structure by suitable clamping devices.

648,487 Electric clock; W. J. Dudley, Somerville, Mass.

648,489 System of distribution; W. L. R. Emmet, Schenectady, N. Y.—Mains connected to the source of supply, compensating machines driven by energy derived from said mains and connected across the mains and to a neutral conductor, shunt-field windings for partially exciting said machines and a series winding on each machine for furnishing the balance of the excitation.

648,492 Thermo-electric generator; J. W. Harrison, Pueblo, Colo.

648,493 Regulating dynamo-electric machines; E. M. Hewlett, Schenectady, N. Y.—A relay having its contacts protected by an auxiliary circuit-breaker controlled by the relay, having its contacts in parallel relation to the relay-contacts, and electro-magnetic means for holding the circuit closed until after the relay-contacts have separated.

648,494 Regulating dynamo-electric machines; E. M. Hewlett, Schenectady, N. Y.

648,505 Electric fishing apparatus; I. W. J. Lindbohm, Helsingfors, Russia.

648,516 Electric lamp, with burner of the second-class; Karl Ochs, Berlin, Germany—Consists of a base adapted to engage with a socket, split end tubes or sockets carried by the said base, and an illuminating structure adapted to be supported in said sockets, comprising a glower, an insulating cross-bar and plugs.

648,517 Electrical glow-light, with illuminating body of second-class conductor; Karl Ochs, Berlin, Germany.

648,518 Electrical resistance; Karl Ochs, Berlin, Germany—An electric resistance and heating conductive body, adapted to act as a heating resistance for a glow-lamp with a second-class conductor illuminating body, the said resistance consisting of metal oxide or oxides formed into a solid mass by glowing and slagging.

648,520 Circuit-breaker for gas engines; J. A. Ostenberg, Westminster, Vt.

648,526 Emergency circuit-closer; A. J. Purinton, Waterbury, Ct.

648,529 Dynamo-electric machine; E. W. Robinson, Schenectady, N. Y.

648,533 Connection-counter for telephone lines; C. E. Scribner, Chicago.

648,543 Electrical attachment for hydrocarbon or other burners; F. Wilke, Ekron, Ohio—Comprises an arm, a sensitive blade fixed through insulation to one end of said metallic arm and an electrical-contact point between said parts at the other end, and a pivot on which the arm is free to swing.

648,546 Electrical measuring instrument; J. F. Begole, St. Louis, Mo.—Consists of a rotary member, of a coil inclined to the axis of said rotary member, a lateral arm carried by said rotary member, and an armature-blade carried by said lateral arm and extending therefrom into said coil.

648,555 Electric switch; W. Ely, Providence, R. I.

(Continued on page 36.)

PATENTS TRADE-MARKS COPYRIGHTS

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"He who knows not, and knows not he knows not—he is a fool; shun him. He who knows not, and knows he knows not—he is simple; teach him. He who knows, and knows not he knows—he is asleep; wake him. He who knows, and knows he knows—he is wise; follow him."—Arab Proverb.

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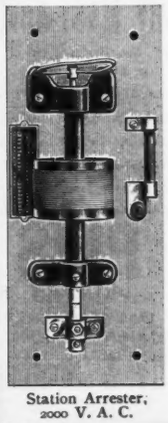

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A National Rider never changes his mount.—National Cycle Mfg. Co., Bay City, Mich.

PATENTS.

(Concluded from page 35.)

648,617 Electro-magnetic automatic weighing machine; Geo. Hoepner, Chicago, Ill.

648,625 Electric arc lamp; H. V. James, Salford, England.

648,647 Latch-drop device for telephone-switchboards; E. E. Yaxley, Chicago, Ill.

648,655 Apparatus for removing deposit of carbon from incandescent electric-light bulbs; E. W. Cushing, Middleton, Mass.—Consists of a pot or crucible, means for heating it, and a lamp-holder adapted to support the lamp in said pot or crucible free from contact therewith.

648,659 Phonographo-telephonic announcer; J. E. Evard, Indianapolis, Ind.

648,660 X-ray apparatus; R. A. Fessenden, Allegheny, Pa.

648,671 Switch for electric circuits; J. T. Robb, New York, N. Y.

648,673 Electrical apparatus for surgeons use; H. Schlesigner, New York.

648,677 Advertising device; F. Alcock, London, England.

648,689 Igniting device for gas engines; Llewellyn Hutchinson, Cambridge, Mass.

648,696 Method of controlling electric motors; M. T. A. Kubierschky, Berlin, Germany—A train comprising one or more motor cars, main conductors on said motor cars, a single pilot-motor on each motor car for operating the controller on said car, a master controller and electrical connections consisting of a single train-conductor for each direction of running.

648,710 Fuse-block; Geo. C. Quelch, Vintondale, Pa.

648,764 Apparatus for producing ozone by electricity; J. H. Lamprey, London, England.

648,786 Vapor burning apparatus and system; E. Phillipson, New York, N. Y.

648,805 Service meter apparatus and circuit for telephone substations; H. E. Shreeve, Boston, Mass.

648,850 Electric line cutout; C. A. Clark, Hartford, Ct.

648,874 Booster apparatus for systems of electrical distribution; Lamar Lyndon, New York, N. Y.

648,892 Electrical resistence; J. F. Bachmann, Vienna, Austria-Hungary.

648,895 Indicator for telephones; C. F. Black, Goshen, Ind.

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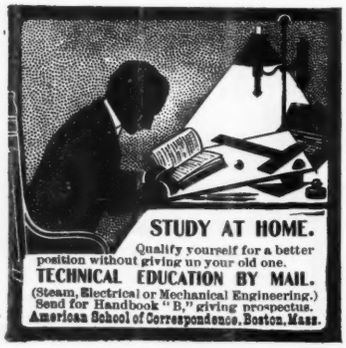

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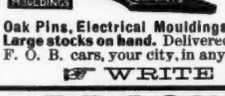

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